IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Atty. Dkt. No. 016790-0398

Applicant: Gerhard HOPPEN

Title: DUV-CAPABLE MICROSCOPE OBJECTIVE WITH PARFOCAL IR FOCUS

Appl. No.: 09/598,406

Filing Date: 06/21/2000

Examiner: A. Chang

Art Unit: 2872

APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Appeal Brief is being filed in accordance with Rule 41.37. The fee required by Rule 41.20(b)(2) is enclosed. If this fee is deemed to be insufficient, authorization is hereby given to charge any deficiency (or credit any balance) to the undersigned's deposit account 19-0741.

REAL PARTY IN INTEREST

The real party in interest is the assignee Leica Microsystems Wetzlar GmbH.

RELATED APPEALS AND INTERFERENCES

None.

STATUS OF CLAIMS

Claims 1 to 20, 22, and 24-28 are pending and are all rejected. All of these claims are on appeal and are set forth in the Claims Appendix.

STATUS OF AMENDMENTS

No amendment was filed subsequent to the April 29, 2004 final rejection.

SUMMARY OF THE CLAIMED SUBJECT MATTER

The invention is directed to a microscope which employs light from two different regions of the electromagnetic spectrum. Light in the deep-ultraviolet region (DUV) is used to provide an image of an object. As discussed on page 1 of the application, DUV light can resolve finer structures as compared to visible light. Light in the infrared region (IR) is used for automatic focusing.

A key feature of the invention is that the invention focuses these two different types of light (DUV and IR) at approximately the same focal point, as discussed on pages 3 to 5 of the application.

Figure 15 provides an overview of the invention. As shown in Figure 15, the invention is used to examine an object (1) using an image beam path (2). DUV light from the object (the DUV light originates from a DUV source not shown in Figure 15 passes through an objective (3) to a beam splitter (4). This beam splitter (4) serves as the input and output element for IR light of an IR autofocus system (5). IR light emerging from IR autofocus system (5) travels via an autofocus beam path (6) and is deflected at beam splitter (4) to objective (3) and thus toward object (1), and returns in the opposite direction to IR autofocus system (5). DUV light from object (1) passes through beam splitter (4) and is imaged by a

tube lens system (7) in an intermediate image plane (8), at the location of the target of a DUV camera (9).

The application sets forth seven embodiments for the objective (3). These objectives are illustrated in Figures 1 to 4 and 17 to 19. Tables 1 to 4 and 6 to 8, respectively, set forth the lens data (geometry of each lens, lens spacing, and lens material) for each objective.

As set forth in claim 1, the invention provides a DUV-capable microscope objective 3 comprising a plurality of lens elements (L1 to L11 in Figures 1 to 4 and 17 to 19) on an object side (the object plane is reference number 1 and thus the object side is the left side of the figures) to generate convergent light. A penultimate lens element (L12 in Figures 1 to 4 and 17 to 19) receives the convergent light from the plurality of lens elements. A further lens element (L13 in Figures 1 to 4 and 17 to 19) on an image side (the right side of the figures) receives light from the penultimate lens element. As described in Tables 1 to 4 and 6 to 8, the plurality of lens elements, the penultimate lens element, and the further lens element are made of quartz glass and fluorite. As indicated, for example, in Figures 9 to 12 and 23 to 25, objective 3 has a DUV focus at a DUV wavelength λ_{DUV} (λ_{DUV} is one wavelength in the deep ultraviolet region between 200 nm and 300 nm) and has an IR focus for an IR wavelength λ_{IR} (λ_{IR} is one wavelength in the infrared region greater than or equal to 760 nm) at the same focal point. (This is also described on page 4, lines 26-31.) The penultimate lens element (L12 in Figures 1 to 4 and 17 to 19) comprises a concave configuration on both sides, wherein an object-side outer radius (the left side of element L12) of the penultimate lens element is smaller than its image-side outer radius (the right side of element L12).

Claim 19 is similar to claim 1 and further recites an IR laser autofocus system (element 5 in Figure 15) in optical communication with the objective (3) to provide light (number in Figure 15) at the IR wavelength and auto-focusing.

Claim 22 is directed to a microscope objective including (as shown in Figures 1 to 4 and 17 to 19) a converging first lens (L1) disposed closest to an object (1) being imaged, a converging second lens (L2) disposed along an optical axis after the first lens, a first doublet lens (L3/L4) disposed along the optical axis after the second lens, a first triplet lens (L5/L6/L7) disposed along the optical axis after the first doublet lens; a second triplet lens (L8/L9/L10) disposed along the optical axis after the first triplet lens; a converging lens group (L11) comprising one or more lenses disposed along the optical axis after the second triplet lens; a diverging penultimate lens (L12) comprising concave outer sides, wherein an object-side (left side of the lens) outer radius is smaller than an image-side (right side of the lens) outer radius disposed along the optical axis after the converging lens group, and a diverging doublet lens (L13) disposed after the penultimate lens. The objective has a focal length of 1.6 mm or less at a DUV wavelength λ_{DUV}, wherein λ_{DUV} is one wavelength in the deep ultraviolet region between 200 nm and 300 nm, and at an IR wavelength λ_{IR}, wherein λ_{IR} is one wavelength in the infrared region greater than or equal to 760 nm, and wherein a numerical aperture of the objective is at least 0.8.

Claim 24 is similar to claim 1 but broader in certain respects.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-18, 19-20, 22, 24 and claims 25-28 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to **enable** one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 19-20, 22 and 26-27 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1, 2, 5, 6, 17-18, 19-20, 24 and claims 25, 26 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over a patent issued to Hayashi (5,121,255) in view of Hecht et al. (Optics, Addison and Wesley 1979, pages 186-191).

ARGUMENT

SECTION 112, FIRST PARAGRAPH, REJECTIONS

The gist of the Examiner's position appears to be that the application does not set forth the essential features required to focus light of substantially different wavelength ranges (DUV and IR) at the same focal point.

The specification is enabling because it provides at least seven different example microscope objectives which provide approximately the same focus for both DUV and IR light. See, e.g., Figs. 1-4 and 17-19. These examples are described in detail in the specification from page 9, line 30 through page 14, line 29. Not only does the specification provide the essential features, the specification provides all of the features of a complete objective.

For example, Fig. 1 shows a first embodiment of a lens design. Here, the penultimate lens element is doublet lens L12a and L12b having the claimed object-side outer radius smaller than the image-side outer radius. The details of how this objective is configured are provided in Table 1 (Fig. 5), which details lens surface curvatures, distances between lens elements, and lens material to build a 125x objective with a focal length of 1.6 mm and a parfocal focus at λ_{DUV} = 248 nm and λ_{IR} at 760 nm. The corresponding spectral image locus curves for this lens are provided in Fig. 9, which shows a minimum at a DUV wavelength λ_{DUV} that defines a zero line (at or about 248 nm ± 8 nm), as well as a zero transition at an IR wavelength λ_{IR} (at or about 760 nm).

The present specification provides an optical designer with at least the following information from which to make the claimed invention:

(1) the appropriate starting system (including the claimed penultimate lens combination) shown in the Figures;

(2) the desired parameters (a microscope objective for DUV imaging, with example focal lengths and numerical apertures) shown in the Tables;

(3) seven different highly detailed working recipes to design a microscope objective to focus DUV and IR wavelengths at the same focal point (see Figs. 5-8 and 20-22);

(4) the desired wavelengths that are to be focused to the same focal point;

(5) lens material (quartz and fluorite materials); and

(6) guidance concerning the size relationship among the outside radii of the lens elements (specification, page 4, lines 9-24).

Based on at least Figs. 1, 5, and 9 and the corresponding text, one skilled in the art could make and use the claimed objective lens without undue experimentation. Similarly, the other six example configurations provide additional teachings to those skilled in the art to make and use the claimed invention without undue experimentation.

Applicant has submitted and made of record a Declaration (Under 37 C.F.R. § 1.132), of Dr. Rainer Schuhmann and Witold Hackemer. Please see Evidence Appendix. This evidence confirms that the present specification enables a person skilled in the art to make and use the claimed invention, and explains why this is the case. Rather than repeat this Declaration herein, the Board is respectfully referred to this Declaration.

As indicated in the Interview Summary of September 16, 2003, the Examiner suggested that the Applicant provide experimental data to support the feature of having a common focal point for DUV and IR light.

In reply, the Applicant submitted and made of record a Declaration by Dagmar Elvers (please see Evidence Appendix), which documents that a commercial embodiment of the invention, having a construction as described in Figures 4 and 8 of the present application, does in fact provide a common focal point for 248 nm light and 904 nm light. Rather than repeat this Declaration herein, the Board is respectfully referred to this Declaration. Accordingly, the invention does work as claimed.

The other comments in the April 29, 2004 Office Action do not raise any legitimate enablement issues. On page two of the Office Action it is stated that the evidence submitted is insufficient to establish actual reduction to practice; however, no evidence is offered to support the Examiner's position. In contrast, the applicant has submitted test data establishing that the invention works and has been commercially accepted. Please see the Declaration by Dagmar Elvers in the Evidence Appendix.

Accordingly, the claimed invention is fully enabled.

SECTION 112, SECOND PARAGRAPH, REJECTIONS

Claims 19-20, 22, and 26-27 stand rejected under section 112, second paragraph, as being indefinite.

Independent Claim 19 and Dependent Claims 20 and 26

The April 29, 2004 Office Action indicates that claim 19 is confusing because it is not clear how an autofocus system can provide a wavelength, which is a number.

This rejection was originally made in April 10, 2003. In the August 11, 2003 amendment, claim 19 was amended to indicate that the autofocus system provides "light at the IR wavelength." Therefore, this rejection is no longer applicable to the claims as they presently stand. The April 29, 2004 Office Action also indicates that the autofocus system is capable of focusing an incident light but does not generate light. However, the autofocus system of the invention does generate light, as discussed with respect to Fig. 15 from the bottom of page 11 to the top of page 12 of the application.

Thus, claims 19, 20, and 26 are not indefinite.

Independent Claim 22 and Dependent Claim 27

The April 29, 2004 Office Action does not set forth a basis for rejecting claims 22 and 27 as indefinite and therefore this rejection should be reversed.

SECTION 103 REJECTIONS

Claims 1, 2, 5, 6, 17-20, 24-26, and 28 are rejected as being unpatentable based on Hayashi in view of Hecht.

The April 29 Office Action correctly acknowledges (on page 5, lines 7-9) that nothing in the prior art explicitly teaches a radius of curvature of a biconcave penultimate lens element at an object side being smaller than at an image side. The Office Action states that "such feature can be easily modified when calculating the lens designs to achieve the same focal points as stated above." The Applicant respectfully disagrees that such a feature would have been obvious because nothing in the prior art suggests such a modification. In fact, Hayashi (if anything) teaches away from the invention because in Hayashi, as indicated in the first and fourth full paragraphs of column 6 of Hayashi, the radius of curvature of the surface on the object side (the left side of Figure 4) is larger than the radius of curvature on the non-object side.

Page 4 of this application explains the non-obvious nature of this invention:

> As a result of the size relationship according to the present invention among the outside radii, the imaging beam that up to that point has been slightly deflected by the preceding lenses or cemented groups is strongly refracted. This kind of beam deflection violates the rule ordinarily applied in optical computation that the beam must always be modified smoothly

> at each imaging element. For example, a sharp transition in the beam makes the objective highly sensitive to tolerances, so that an objective of this kind is difficult to produce or makes stringent demands in terms of production.
>
> On the other hand, however, only with a penultimate element having this particular shape did it prove possible to achieve the same focus both for a region around a DUV wavelength λ_{DUV} and for an IR wavelength λ_{IR}. If the relevant penultimate element is equipped, in an objective according to the present invention, with a moderate shape so that the previously deflected beam profile is smoothed again, then both the good correction and the focus for the IR wavelength λ_{IR} are lost.

It is noted that the Office Action of April 10, 2003, on page 5, stated that Figure 4 of Hayashi discloses a penultimate lens element 23 having a biconcave configuration with the object side radius being <u>smaller</u> than the image-side radius. The Applicant pointed out in the August 11, 2003 reply that, as indicated in the first and fourth full paragraphs of column 6 of Hayashi, the radius of curvature of the surface on the object side (the left side of Figure 4) is larger than the radius of curvature on the non-object side and that Hayashi is completely opposite from the claimed invention. The April 29, 2004 Office Action now takes a view opposite the one taken in the April 10, 2003 Office Action.

It is also noted that portions of the April 29, 2004 Office Action itself appear to agree that the invention is not obvious. Page 3 states (emphasis by Examiner):

> "[i]t is therefore **not obvious** why would the light having very different wavelengths to be focused at the same point."

Page 6 states:

> "The facts that the two wavelengths are so different and the lens materials in general have none identical index of refraction for different wavelength ranges, which gives up different dispersion properties, make it not **obvious** that the focal points for light in very different wavelength ranges to be the same."

Finally, the comments bridging pages 6 and 7 of the April 29 Office Action that biconcave lenses are well known are not on point, because the Applicant is claiming a combination of elements and features, which combination is not taught by the prior art.

CONCLUSION

It is respectfully submitted that all rejections should be reversed.

Respectfully submitted,

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By

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CLAIMS APPENDIX

1. A DUV-capable microscope objective, comprising:

a plurality of lens elements, on an object side, to generate convergent light;

a penultimate lens element which receives the convergent light from the plurality of lens elements; and

a further lens element, on an image side, which receives light from the penultimate lens element; wherein

the plurality of lens elements and the penultimate lens element and the further lens element are made of quartz glass and fluorite,

the objective has a DUV focus at a DUV wavelength λ_{DUV}, wherein λ_{DUV} is one wavelength in the deep ultraviolet region between 200 nm and 300 nm,

the objective has an IR focus for an IR wavelength λ_{IR}, wherein λ_{IR} is one wavelength in the infrared region greater than or equal to 760 nm, at the same focal point as the DUV focus at λ_{DUV}, and

the penultimate lens element comprises a concave configuration on both sides, wherein an object-side outer radius of the penultimate lens element is smaller than its image-side outer radius.

2. The objective as defined in Claim 1, wherein the penultimate lens element is a doublet, concave on both sides, and has a material sequence of quartz glass/fluorite in an imaging direction.

3. The objective as defined in Claim 1, wherein the penultimate lens element is a diverging triplet lens, concave on both sides, and has a material sequence of quartz glass/fluorite/quartz glass in an imaging direction.

4. The objective as defined in Claim 1, wherein the penultimate lens element is a diverging triplet lens, concave on both sides, that has a material sequence of quartz glass/lithium fluoride/quartz glass in an imaging direction.

5. The objective as defined in Claim 1, wherein the penultimate lens element is diverging, is concave on both sides, and comprises individual lenses made of quartz glass and fluorite.

6. The objective as defined in Claim 1, wherein the penultimate lens element is diverging, is concave on both sides, and comprises individual lenses made of quartz glass and lithium fluoride.

7. The objective as defined in Claim 1, wherein the objective comprises, as viewed in an imaging direction:

a converging individual first lens comprising quartz glass as a front lens element disposed closest to an object being imaged;

a converging individual second lens element comprising fluorite;

a first doublet comprising a diverging third lens comprising quartz glass and a converging fourth lens comprising fluorite;

a first triplet combined of a fifth lens comprising fluorite, a sixth lens comprising quartz glass and a seventh lens comprising fluorite;

a second triplet combined of an eighth lens comprising quartz glass and a ninth lens comprising fluorite and a tenth lens comprising quartz glass;

a converging lens group comprising one or more lenses;

and

the further lens element in the form of a diverging doublet comprising a converging lens comprising quartz glass and a diverging lens comprising fluorite,

wherein the penultimate lens element is diverging and is disposed between the converging lens group and the diverging doublet.

8. The objective as defined in Claim 7, wherein the converging individual second lens and the first doublet are combined into a triplet lens having a material sequence fluorite/quartz glass/fluorite.

9. The objective as defined in Claim 7, wherein the objective has a DUV focus in a DUV wavelength region $\lambda_{DUV} = 248$ nm $\pm$ 8 nm or in a DUV wavelength region $\lambda_{DUV} = 266$ nm $\pm$ 8 nm.

10. The objective as defined in Claim 7, wherein the DUV focus includes a DUV wavelength region $\lambda_{DUV} = 248$ nm $\pm$ 8 nm and an IR focus at $\lambda_{IR} = 760$ nm.

11. The objective as defined in Claim 7, wherein the DUV focus includes a DUV wavelength region $\lambda_{DUV} = 248$ nm $\pm$ 8 nm and an IR focus at $\lambda_{IR} = 825$ nm.

12. The objective as defined in Claim 7, wherein the DUV focus includes a DUV wavelength region $\lambda_{DUV} = 248$ nm $\pm$ 8 nm and an IR focus at $\lambda_{IR} = 885$ nm.

13. The objective as defined in Claim 7, wherein the DUV focus includes a DUV wavelength region λ_{DUV} = 248 nm ± 8 nm and an IR focus at λ_{IR} = 905 nm.

14. The objective as defined in Claim 8, wherein the DUV focus includes a DUV wavelength region λ_{DUV} = 266 nm ± 8 nm and an IR focus at λ_{IR} = 780 nm.

15. The objective as defined in Claim 7, wherein the DUV focus includes a DUV wavelength region λ_{DUV} = 266 nm ± 8 nm and an IR focus at λ_{IR} = 785 nm.

16. The objective as defined in Claim 8, wherein the DUV focus includes a DUV wavelength region λ_{DUV} = 266 nm ± 8 nm and an IR focus at λ_{IR} = 845 nm.

17. The objective as defined in Claim 1, wherein λ_{IR} has a wavelength such that 760 nm ≥ λ_{IR} ≥ 920 nm.

18. The objective as defined in Claim 1, wherein the objective has a focal length of 1.6 mm or less.

19. A DUV-capable microscope, comprising:

an objective comprising a plurality of lens elements, on an object side, to generate convergent light; a penultimate lens element which receives the convergent light from the plurality of lens elements; and a further lens element, on an image side, which receives light from the penultimate lens element, wherein the objective has a DUV focus at a DUV wavelength λ_{DUV}, wherein λ_{DUV} is one wavelength in the deep ultraviolet region between 200 nm and 300 nm, wherein the objective has an IR focus for an IR wavelength λ_{IR}, wherein λ_{IR} is one wavelength in the infrared region greater than or equal to 760 nm, at the

same focal point as the DUV focus at λ_{DUV}, and wherein the penultimate lens element comprises a concave configuration on both sides, wherein an object-side outer radius of the penultimate lens element is smaller than its image-side outer radius; and

an IR laser autofocus system in optical communication with the objective to provide light at the IR wavelength λ_{IR} and auto-focusing.

20. The microscope as defined in Claim 19, wherein the objective has a focal length of 1.6 mm or less.

21. (Cancelled).

22. A microscope objective, comprising:

a converging first lens disposed closest to an object being imaged;

a converging second lens disposed along an optical axis after the first lens;

a first doublet lens disposed along the optical axis after the second lens;

a first triplet lens disposed along the optical axis after the first doublet lens;

a second triplet lens disposed along the optical axis after the first triplet lens;

a converging lens group comprising one or more lenses disposed along the optical axis after the second triplet lens;

a diverging penultimate lens comprising concave outer sides, wherein an object-side outer radius is smaller than an image-side outer radius disposed along the optical axis after the converging lens group; and

a diverging doublet lens disposed after the penultimate lens,

wherein the objective has a focal length of 1.6 mm or less at a DUV wavelength λ_{DUV}, wherein λ_{DUV} is one wavelength in the deep ultraviolet region between 200

nm and 300 nm, and at an IR wavelength λ_{IR}, wherein λ_{IR} is one wavelength in the infrared region greater than or equal to 760 nm, and wherein a numerical aperture of the objective is at least 0.8.

23. (Cancelled).

24. A DUV-capable microscope, comprising:

an objective comprising a plurality of lens elements, on an object side, to generate convergent light; a penultimate lens element which receives the convergent light from the plurality of lens elements; and a further lens element, on an image side, which receives light from the penultimate lens element; wherein

the objective has a DUV focus at a DUV wavelength,

the objective has an IR focus for an IR wavelength at the same focal point as the DUV focus, and

the penultimate lens element comprises a concave configuration on both sides, wherein an object-side outer radius of the penultimate lens element is smaller than its image-side outer radius.

25. The objective as defined in Claim 1, wherein the objective has a numerical aperture of at least 0.90.

26. The microscope as defined in Claim 19, wherein the objective has a numerical aperture of at least 0.90.

27. The objective as defined in Claim 22, wherein the objective has a numerical aperture of at least 0.90.

28. The microscope as defined in Claim 24, wherein the objective has a numerical aperture of at least 0.90.

EVIDENCE APPENDIX

A Declaration (Under 37 C.F.R. § 1.132) of Dr. Rainer Schuhmann and Witold Hackemer was filed on January 9, 2003, and was entered by the Examiner as indicated on page 2 of the April 10, 2003 Office Action, and is enclosed herewith.

A Declaration of Dagmar Elvers was filed on February 5, 2004, was entered by the Examiner as indicated on page 2 of the April 29, 2004 Office Action, and is enclosed herewith.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:

Gerhard HOPPEN

Serial No.: 09/598,406 | Examiner: A. Chang

Filed: June 21, 2000 | Art Unit: 2872

Title: DUV-CAPABLE MICROSCOPE OBJECTIVE WITH PARFOCAL IR FOCUS

DECLARATION (UNDER 37 C.F.R. § 1.132) OF DR. RAINER SCHUHMANN AND WITOLD HACKEMER

We, (a) Dr. Rainer Schuhmann and (b) Witold Hackemer,

declare and state as follows:

1.(a) I, Rainer Schuhmann, am currently employed as Vice President / Business Division Manager Industrial Manufacturing at LINOS Photonics GmbH & Co. KG and have worked at LINOS since 1989. During my tenure at LINOS, I have worked in the field of optical design, especially lens design. I also worked as Director of the R&D Department and Quality Management for LINOS. Prior to that, I was employed at Schneider Kreuznach from 1985 to 1989 as head of the Optical Design Department, working in the field of optical design. LINOS is a customer of Leica, as well as other optics/optical systems companies.

1. (b) I, Rainer Schuhmann, received a Diploma Degree in Physics from the Technical University of Berlin in 1980. I received my Ph.D. in Physics from the Technical University of Berlin in 1985. During my physics study and Diploma work my education was concentrated in the area of Technical Optics. My Ph.D. thesis was about optical design principles using aspheric surfaces. Speaking and understanding fluently the English language is a standard basis for my daily business.

(see brief biography attached)

2.(a) I, Witold Hackemer, am currently employed as an Optical Designer in the R&D Department in the Business Division Industrial Manufacturing at LINOS Photonics GmbH & Co. KG and have worked at LINOS since 2000. During my tenure at LINOS, I have worked as Senior Optical Designer in the field of optical design, especially lens design, optical system design, and optical technologies. Prior to that, I was employed at Steag-Eta-Optik as Senior Optical Designer from 1997 to 2000.

2. (b) I, Witold Hackemer, received a Diploma Degree in the discipline of Precision Optics/Mechanics from the Polytechnical University of Warsaw in 1978. During my study and examination work I was involved in Optical System Design, Optical Technologies, and Metrology. Speaking and understanding fluently the English language is part of my daily work which includes contacts with colleagues and the reading of technical papers and books.

(see brief biography attached)

3. We have authored or co-authored numerous scientific articles and presentations related to optical design and optical lens design technology. Examples of these papers and talks include principles of lens design and special design solutions (see the attached list).

4. I have reviewed the following documents concerning U.S. Application Serial No. 09/598,406 (the '406 application): the specification and claims as filed on June 21, 2000; a copy of the Office Action dated May 9, 2001, a copy of the response filed on November 9, 2001 (including the amendments to the claims); a copy of the Office Action dated January 10, 2002; a copy of the response filed on June 10, 2002 (including attachments); and a copy of the Advisory Action dated June 19, 2002.

5. We are being compensated by Leica for our Declaration at our normal hourly consultation rate of € 100.- per hour.

6. As discussed below, based on the description of the invention provided in the specification of the application and the knowledge of one of ordinary skill in the field of optics, one skilled in the pertinent art could have made and used the invention as defined in claim 1 without undue experimentation.

7. Based on our work experience, our academic experience, and our expertise, a person of ordinary skill in optical design, specifically lens design, as of July 9, 1999, the priority date for the '406 application (corresponding to the filing date of the German priority application no. 199 31 949.9), has the following qualities and background:

- basic education in technical optics
- education in lens design
- experiences / knowledge in optical metrology
- experiences / knowledge in optical technologies (optics production)
- several years of working experience in lens design of imaging systems on an industrial level

As to the education, a person of ordinary skill in optical system/lens design in July 1999 would have a graduate (or equivalent) degree in the field of physics, mathematics, optics, or optical design, and at least four to six years working experience designing optical systems, lenses and/or lens systems.

Driven by the needs for new applications of microscope objectives the optical designer is confronted with the need to develop new lens geometries satisfying new lens correction criteria.

The designer of ordinary skill would understand lens system aberration theory and have the necessary skills to lead the design process towards the fulfilment of the lens specification. The designer would base the lens designs on the available state of technology. When building a new lens system, such as a microscope objective, the designer proceeds through the following design steps:

1 Establishes a paraxial model for the system,

2 Conducts and evaluates existing solutions; i.e. for example, conducts a patent and literature search.

3 Develops a starting lens design.

4 Conducts preliminary optimisation of starting designs.

5 Develops an intermediate design on the basis of some specific preliminary designs.

6 Conducts final optimisation of preliminary designs to obtain final designs.

7 Proceeds with a tolerance study of the final design, as well as, adjusts the final radii to the existing set of factory test plates.

8 The designer establishes a lens compensation scheme based on the results of the tolerance study. A lens compensation scheme allows for the adjustment of lens sub assemblies during production to compensate tolerances of individual lens elements.

9 Supports lens mechanical design activities.

Notes: The criteria for completing steps 4 through 6 rely on the assessment of the state of correction of lens aberrations. For example, chromatic lens aberrations can be assessed with the help of the spectral image locus chart. The process of lens optimisation relies on the iteration of design variables resulting in the reduction of lens aberrations.

There exist the following commercial standard optical design programs: Code V, Zemax, Oslo, Sigma, etc. In addition, individual lens manufacturers, such as Zeiss, Rodenstock, Leitz / Leica, and Schneider, have developed their own lens design software for their internal use. Computer design software allows for numerical accuracy never before achievable by the designer. Both individual optical design software and commercial optical design software listed above have been available since prior to July 1999. Consequently, computers have permitted optical designers the achievement of designs with an unmatched degree of complication and accuracy.

With respect to one of the problems discussed in the patent application, chromatic aberrations, prior art solutions for simple lens systems have centered on the development of achromatic lenses. For example, the standard optics textbook, "Optics", Hecht and Zajac, Addison-Wesley Publishing, 1974 edition, discusses a simple focusing scheme at different wavelengths of light at the same focal point. A copy of this discussion, which is known to those of ordinary skill in the art, has been presented to the Patent Office in the response dated June 10, 2002. Thus, a person of ordinary skill in the art would know how to compensate for chromatic aberrations in a simple single lens system. (See the attached table entitled "Literature" which notes references addressing chromatic aberrations).

8. Claim 1 (as amended in the response filed on June 10, 2002) recites:

> 1. (Twice Amended)
> A DUV-capable microscope objective, comprising:
> a lens group that comprises a plurality of lens elements made of quartz glass and fluorite, wherein the objective has a DUV focus at a DUV wavelength, $\lambda_{DUV} \geq 235$ nm, wherein the DUV focus encompasses a DUV wavelength region $\lambda_{DUV} \pm \Delta\lambda$, where $\Delta\lambda = 8$ nm, wherein the objective has an IR focus for an IR wavelength $\lambda_{IR} \geq 760$ nm at the same focal point as the DUV focus at λ_{DUV}, and wherein a penultimate lens element of the lens group comprises a concave configuration on both sides, wherein an object-side outer radius of the penultimate element is smaller than its image-side outer radius.

9. We have reviewed the teachings of the '406 application in great detail. The general invention as claimed above is based on a lens design configuration by a special geometry of a set of lens elements in combination with a special selection of the glass materials of these elements. With this configuration the described imaging performance can be achieved. A person of ordinary skill in the art could make and use this invention based solely on the description of the invention in the '406 application combined with that person's knowledge for the following reasons:

(a) Example: First, Tables 1-4 and 6-8 provide detailed optical prescriptions from which the microscope objective of claim 1 can be constructed, and could have been constructed as of July 9, 1999, the priority date of the '406 application. The procedures set forth below were all readily available as of July 9, 1999.

Generally, a person of ordinary skill in the art would review the prescription, for example Table 1, to determine the lens materials and configurations needed. Next, that person would order blanks of the appropriate materials from a commercial vendor. Then, the person would machine and polish the blanks into the appropriate lens configurations, as set forth in the prescription. The materials set forth in Table 1 are commonly used in optical equipment and such blanks are readily available. Any optical shop that makes microscope objectives or similar lenses would have the capability to machine and polish the blanks, using commercially available equipment, in accordance with the prescription. Next, the person of ordinary skill would take the polished lenses and place them in a holder, spacing the lenses in accordance with the prescription. During the assembly process, alignment of the lenses would be carried out in order to ensure that optical axes are in alignment and that proper spacing is provided. Assembly of the

lenses in the holder is well within the capability of any optical shop that makes microscope objectives or similar lenses. After assembly, the objective can be tested on a test optical bench to make sure that the intended magnification and other features have been met. Thus, a person of ordinary skill in the art can make an objective in accordance with claim 1 in a straightforward manner, without having to perform any undue experimentation. Based on our experience and the types of materials and lens configurations detailed in Fig. 1, such an objective can be built. Depending on the experience in construction and assembling a microscopic objective of such type the typical timeframe for a person of ordinary skill for construction (mechanical design / system design) would be 1 to 3 months. Building a working prototype for use in a microscope using all finished optical and mechanical parts would be an additional 1 to 2 weeks including testing. These timeframes are typical for the construction and prototyping of microscope objectives based on an existing optical design (optical prescription).

This process can be carried out in a similar manner for any of the seven prescriptions disclosed in the '406 application. Documentations on the performance of the lens objectives are made using two different optical design software programs (see attached figures, corresponding to nomenclature of '406 application). In general, this lens design principle can be used for other variations of the basic design successfully by an experienced optical designer.

(b) Spectral Image Locus Graphs

The spectral image locus curves (see e.g. Figs. 9-12 and 23-25) show the axial location of the microscope objective focal point as a function of wavelength of light. The spectral image locus also depends on the relative ray height in the pupil. The area bound by the two curves on the chart defines a family of curves for relative pupil coordinates varying from zero (for paraxial rays), to maximum pupil size (for rim rays). The spectral image locus curve for paraxial rays is

designated with a continuous line and the spectral image locus for rim rays is described with a dashed line. The chart conveys the information that the microscope objective has a common focus at two separate wavelength regions.

The first focus exists in the deep ultraviolet (DUV) spectrum, for example, at 248nm +/- 8nm, and the second focus exists in the IR region for wavelengths in the range from 760nm to 905nm. The information about the two common focus regions contained in the chart of spectral image focus shift is a very important criterion of assessing lens performance. In other words, such a lens objective can be used in a microscope system simultaneously at two wavelengths having a large spectral separation.

Based on the teachings of the '406 application a person of ordinary skill in the art of lens design requires a time frame of about one week for verification and/or testing of the lens design.

The '406 application teaches the necessary starting parameters, including the composition and optical prescription for the penultimate lens, for building a microscope objective/lens assembly having the claimed features. Without these teachings, however, a complete new design of a dry lens objective having, e.g., a focal length of ~1.5mm, a working distance of ~0.2mm, a numerical aperture of ~0.9, a comparable image correction, and the just described chromatic correction at both DUV and at the IR spectral region is not a trivial undertaking and may take years for a person of ordinary skill in the art.

Declaration of Dr. Rainer Schuhmann and Witold Hackemer
US Application Serial No. 09/598,406

We further declare that all statements made herein of our own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Executed on:

2003-01-07
Date

Dr. Rainer Schuhmann

2003-01-07
Date

i.A.
Witold Hackemer

002.948788.1

Brief biography:

Dr. Rainer Schuhmann, born in 1953 in Berlin, study of physics at the Technical University of Berlin, Ph.D. in physics on Optical Design with aspherical surfaces, four years at Schneider Kreuznach as head of the Optical Design Department, since 1989 at Spindler & Hoyer in Goettingen, company renamed in 1999 to LINOS Photonics, as Director of R&D and Quality Management, today as Vice President, Manger Business Division Industrial Manufacturing, fellow of German Society of Applied Optics (DGaO), European Optical Society (EOS) and American Optical Society (OSA), board member of the DGaO.

DECLARATION ATTACHMENT

Brief biography:

Witold Hackemer, born in 1956 in Slupsk/Poland, studied precision mechanics/optics, and telecommunications in Warszawa and in Gdansk respectively. Worked until 1987 as an optical engineer in Poland. From 1988 till 1996 worked for Pioneer Deutschland in the area of opto-electronics.
Worked at Steag-ETA-Optik in Heinsberg between 1997 and 2000 as an optical engineer and optical designer.
Since 2000 until present employed as senior optical designer at LINOS-Photonics in Goettingen.

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CaF2 and Silica in OSLO and ZEMAX.txt

System/Prescription Data

File : D:\Wit_Patente\Leica\CaF2&Silica.ZMX
Title: CaF2 and Quartz glass in OSLO and ZEMAX
Date : FRI NOV 22 2002

LENS NOTES:

CaF2 and Silica in OSLO and ZEMAX

INDEX OF REFRACTION DATA:

Surf	Glass	Temp	Pres	0.240000	0.248000	0.256000	0.258000	0.266000	0.274000
0	CAF2	20.00	1.00	1.47120407	1.46803296	1.46520977	1.46455214	1.46209329	1.45988044
1	SILICA	20.00	1.00	1.51332759	1.50855070	1.50432330	1.50334192	1.49968341	1.49640520

Surf	Glass	Temp	Pres	0.760000	0.825000	0.885000	0.905000
0	CAF2	20.00	1.00	1.43097421	1.43027703	1.42973618	1.42957278
1	SILICA	20.00	1.00	1.45404326	1.45289701	1.45197066	1.45168284

THERMAL COEFFICIENT OF EXPANSION DATA:

Surf	Glass	TCE *10E-6
0	CAF2	18.90000000
1	SILICA	0.50000000

Fig. 01.

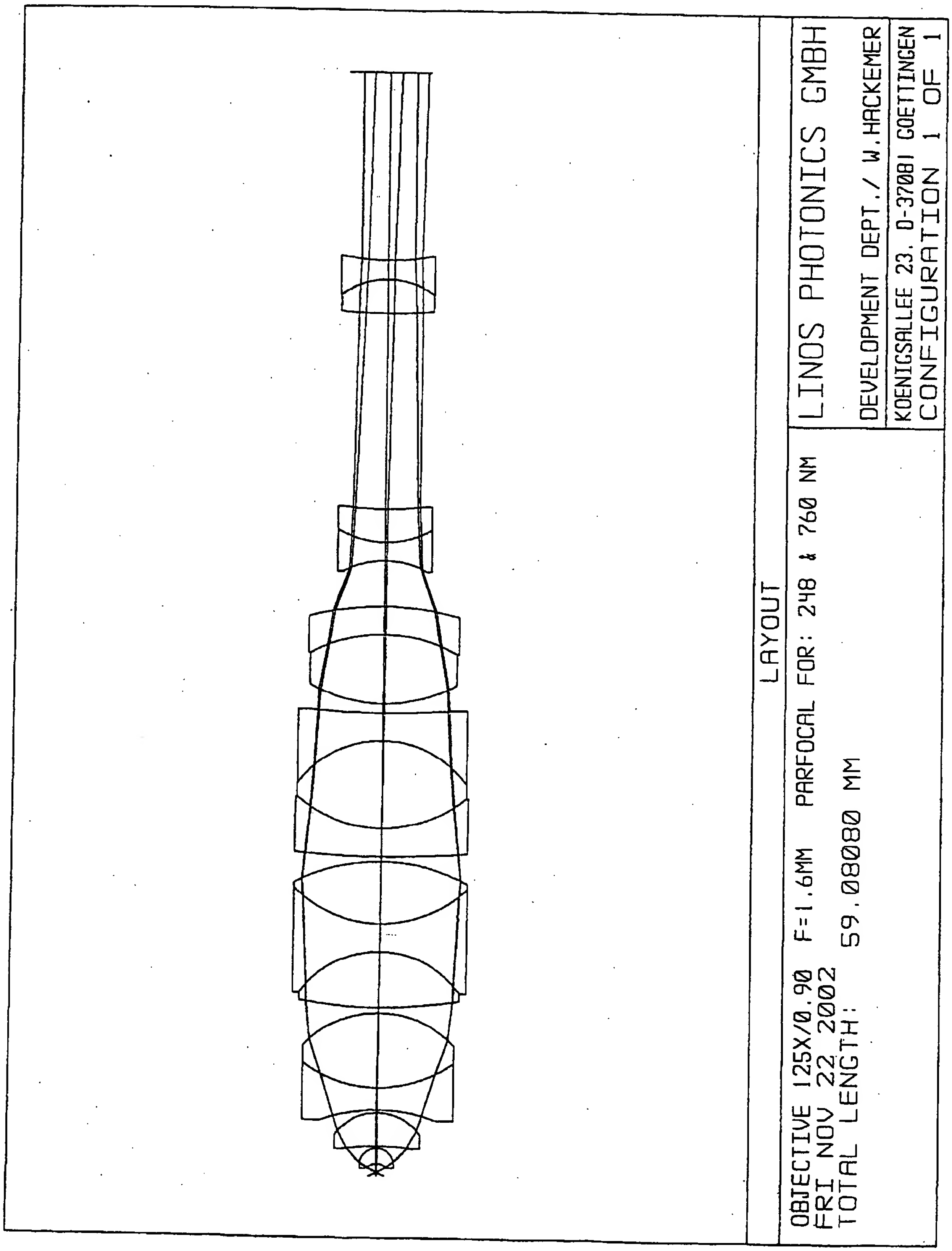

LAYOUT
OBJECTIVE 125X/0.90 F=1.6MM PARFOCAL FOR: 248 & 760 NM
FRI NOV 22 2002
TOTAL LENGTH: 59.08080 MM
LINOS PHOTONICS GMBH
DEVELOPMENT DEPT./ W.HACKEMER
KOENIGSALLEE 23, D-37081 GOETTINGEN
CONFIGURATION 1 OF 1

Fig. 01 - sphe.

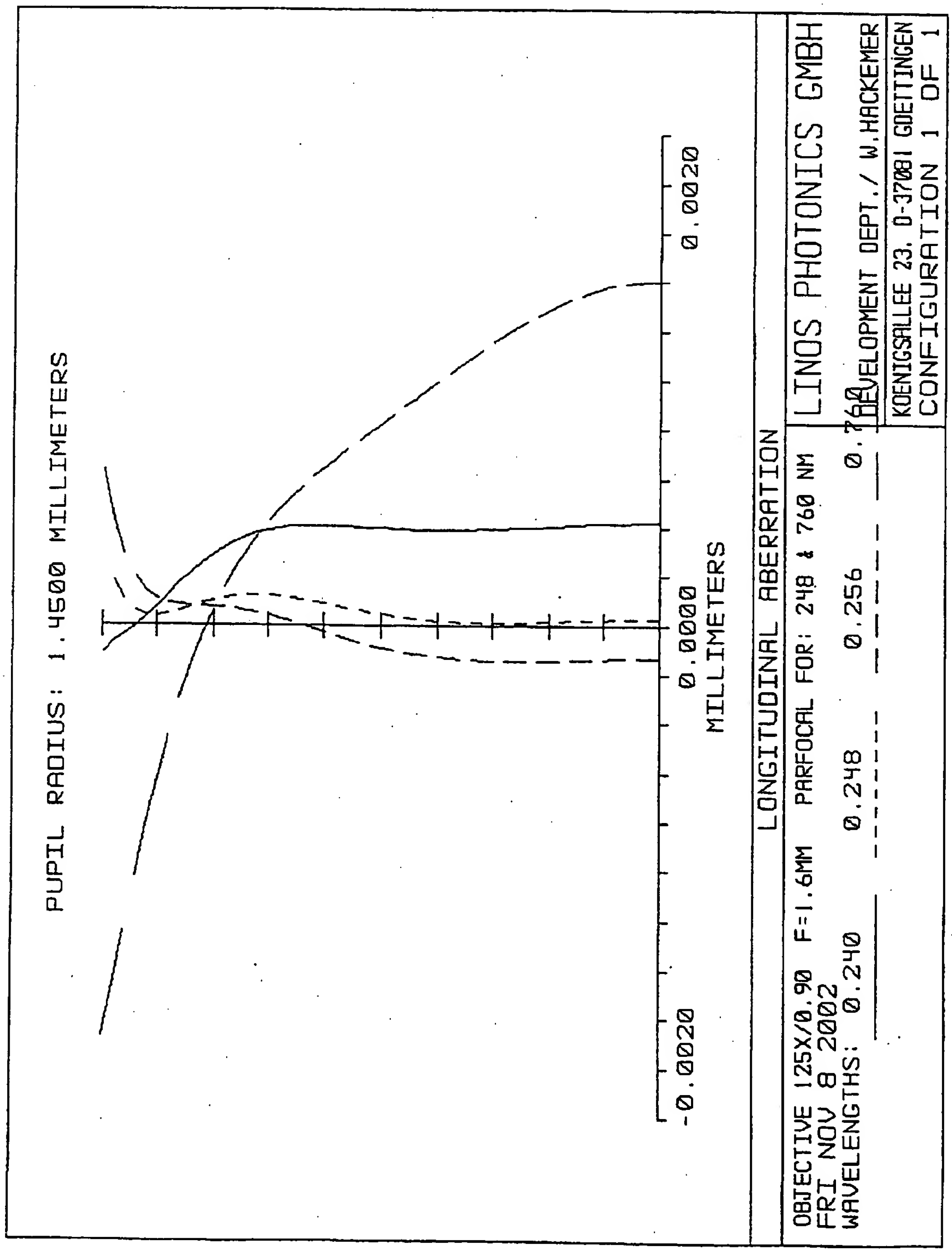

PUPIL RADIUS: 1.4500 MILLIMETERS
-0.0020
0.0000
0.0020
MILLIMETERS
LONGITUDINAL ABERRATION
OBJECTIVE 125X/0.90 F=1.6MM PARFOCAL FOR: 248 & 760 NM
FRI NOV 8 2002
WAVELENGTHS: 0.240 0.248 0.256 0.760
LINOS PHOTONICS GMBH
DEVELOPMENT DEPT./ W.HACKEMER
KOENIGSALLEE 23, D-37081 GOETTINGEN
CONFIGURATION 1 OF 1

Fig. 04.

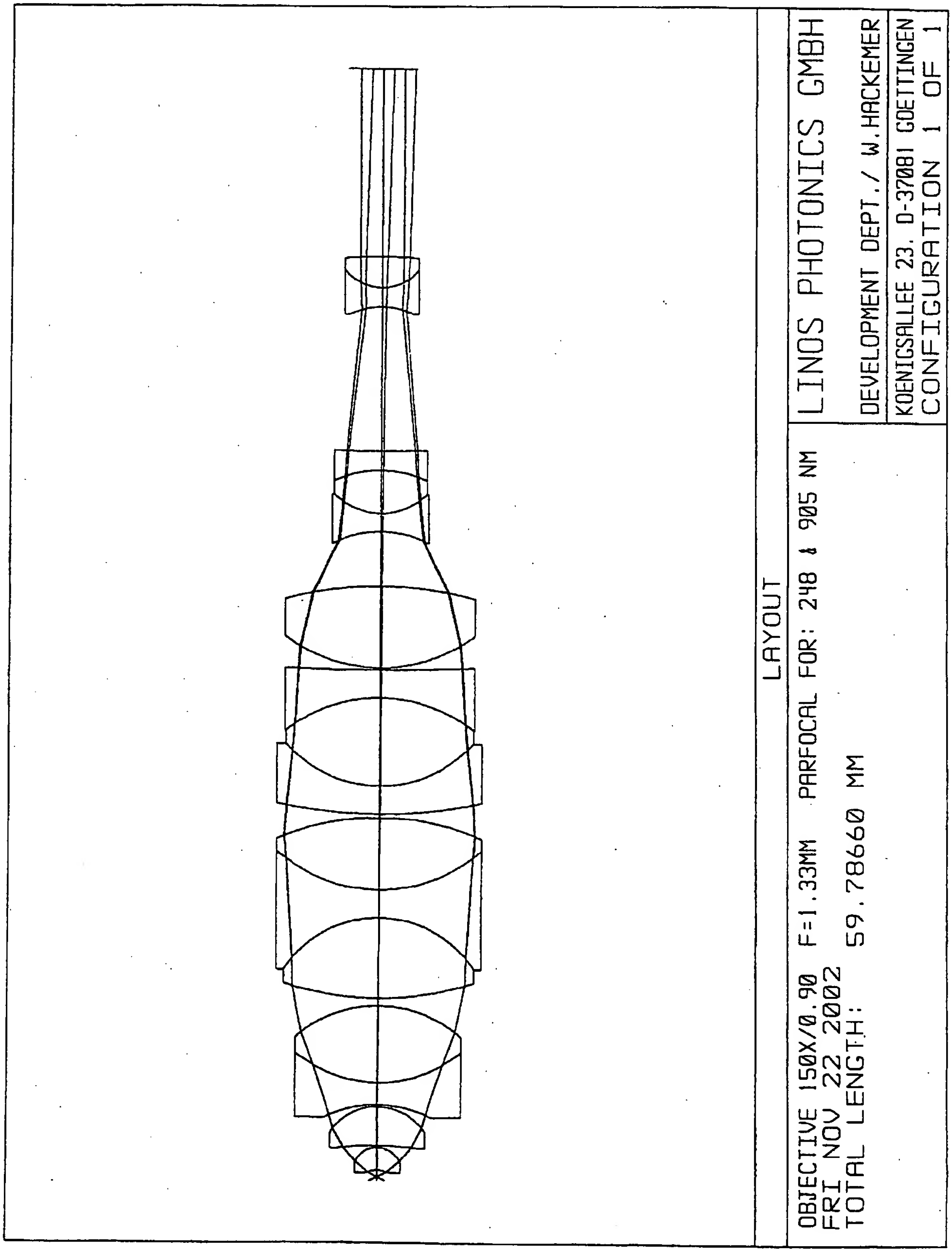
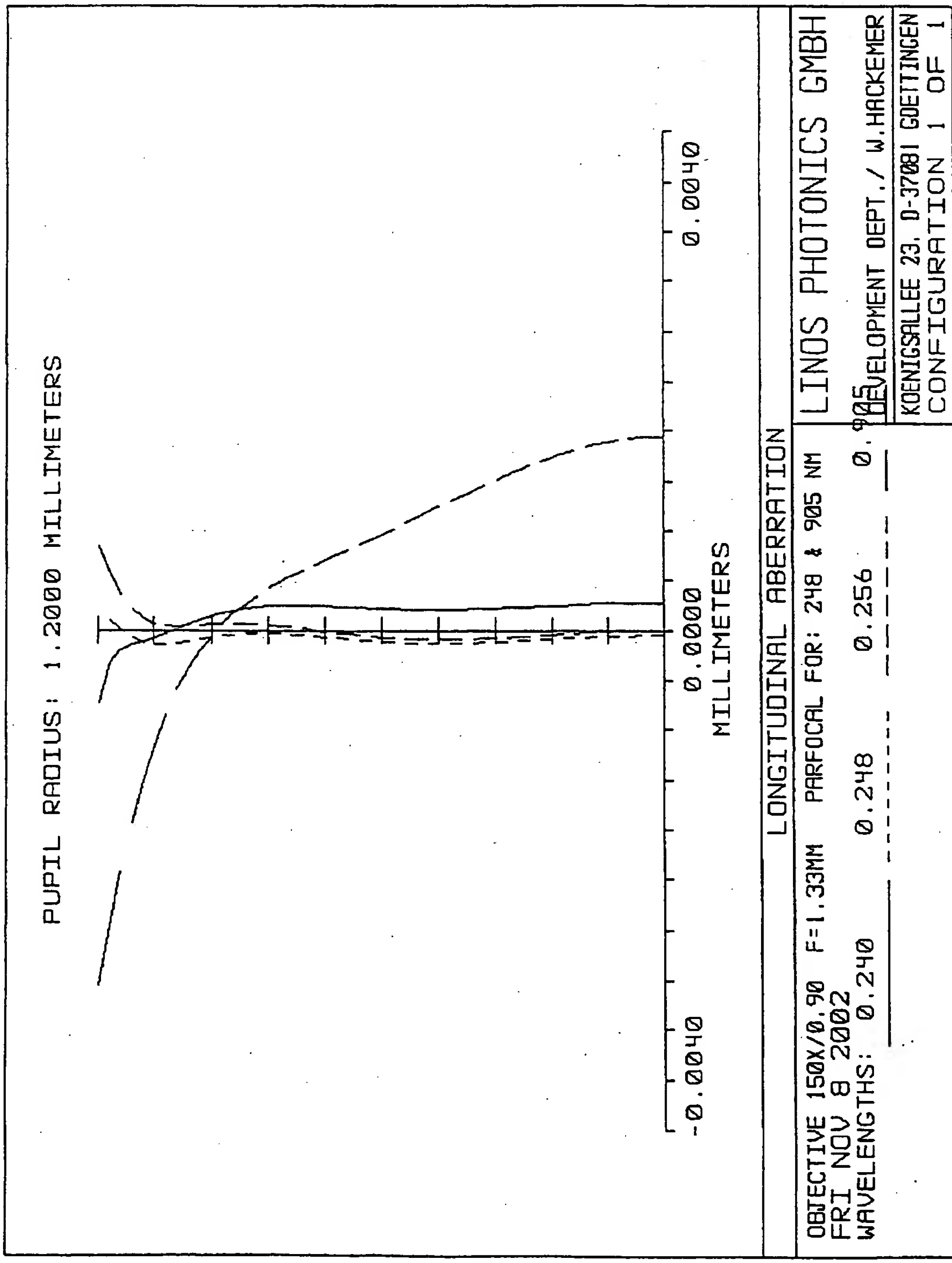

LAYOUT
LINOS PHOTONICS GMBH
DEVELOPMENT DEPT./ W.HACKEMER
KOENIGSALLEE 23. D-37081 GOETTINGEN
CONFIGURATION 1 OF 1
OBJECTIVE 150X/0.90 F=1.33MM PARFOCAL FOR: 248 & 905 NM
FRI NOV 22 2002
TOTAL LENGTH: 59.78660 MM

Fig. 04_sphe.


PUPIL RADIUS: 1.2000 MILLIMETERS
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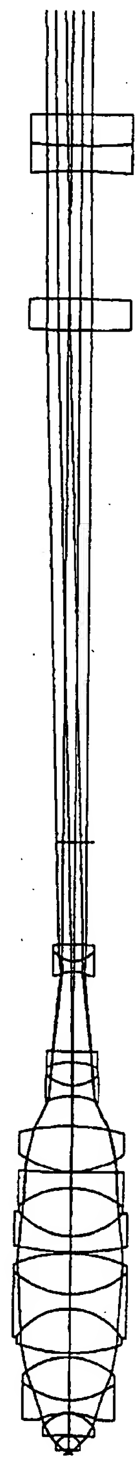
0.0000
0.0040
MILLIMETERS
LONGITUDINAL ABERRATION
OBJECTIVE 150X/0,90 F=1.33MM PARFOCAL FOR: 248 & 905 NM
FRI NOV 8 2002
WAVELENGTHS: 0.240 0.248 0.256 0.905
LINOS PHOTONICS GMBH
DEVELOPMENT DEPT./ W.HACKEMER
KOENIGSALLEE 23, D-37081 GOETTINGEN
CONFIGURATION 1 OF 1

Fig. 04+13.



LINOS PHOTONICS GMBH
DEVELOPMENT DEPT./ W.HACKEMER
KOENIGSALLEE 23. D-37081 GOETTINGEN
CONFIGURATION 1 OF 1

LAYOUT

OBJECTIVE 150X/0.90 F=1.33MM PARFOCAL FOR: 248 & 905 NM
FRI NOV 22 2002
TOTAL LENGTH: 140.75660 MM

Fig. 09.

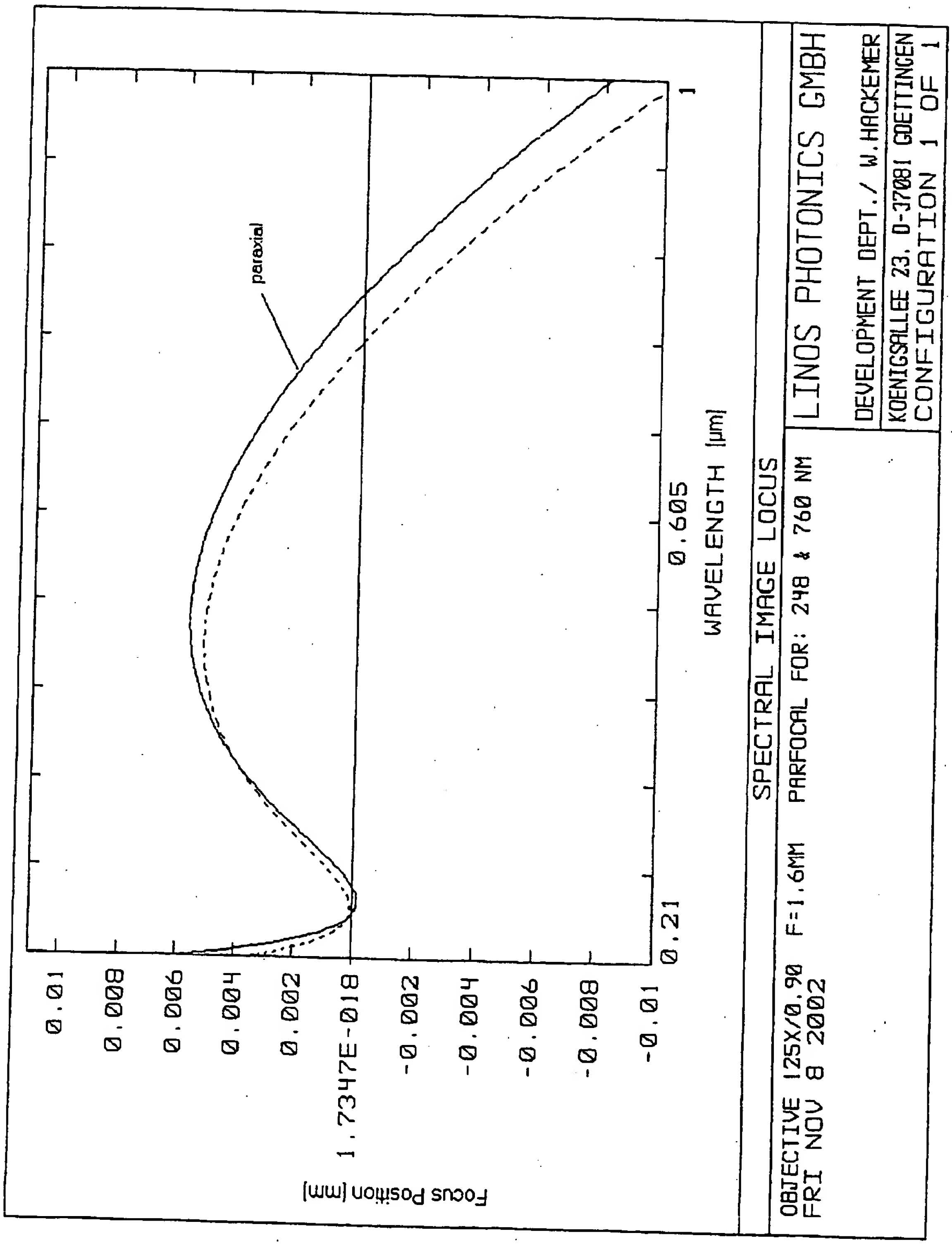

paraxial
0.01
0.008
0.006
0.004
0.002
1.7347E-018
-0.002
-0.004
-0.006
-0.008
-0.01
Focus Position [mm]
0.21
0.605
1
WAVELENGTH [µm]
SPECTRAL IMAGE LOCUS
OBJECTIVE 125X/0.90 F=1.6MM PARFOCAL FOR: 248 & 760 NM
FRI NOV 8 2002
LINOS PHOTONICS GMBH
DEVELOPMENT DEPT. / W.HACKEMER
KOENIGSALLEE 23, D-37081 GOETTINGEN
CONFIGURATION 1 OF 1

Fig. 10.

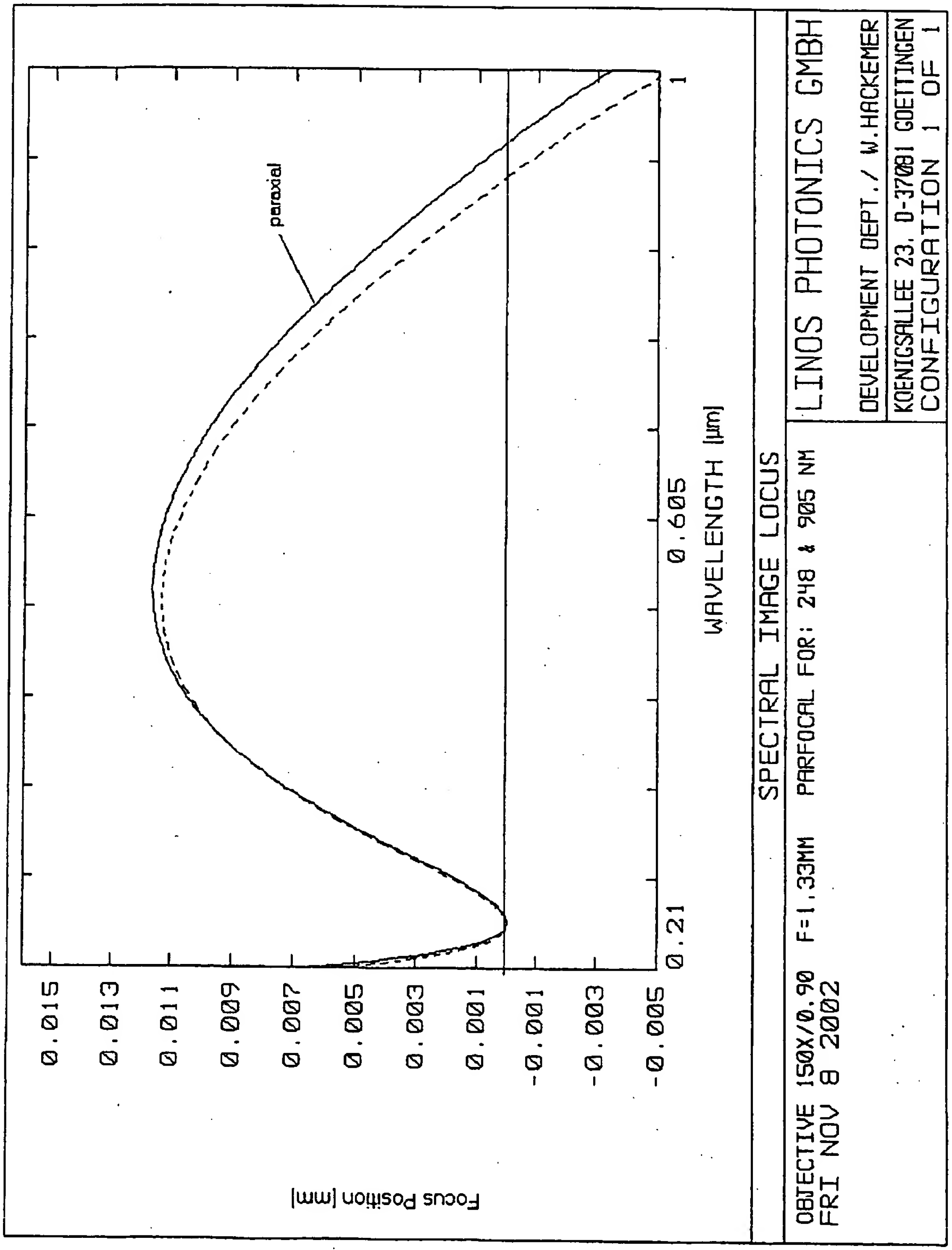

paraxial
Focus Position [mm]
0.015
0.013
0.011
0.009
0.007
0.005
0.003
0.001
-0.001
-0.003
-0.005
0.21
0.605
1
WAVELENGTH [µm]
SPECTRAL IMAGE LOCUS
OBJECTIVE 150X/0.90 F=1.33MM PARFOCAL FOR: 248 & 905 NM
FRI NOV 8 2002
LINOS PHOTONICS GMBH
DEVELOPMENT DEPT./ W.HACKEMER
KOENIGSALLEE 23, D-37081 GOETTINGEN
CONFIGURATION 1 OF 1

Fig. 16a.

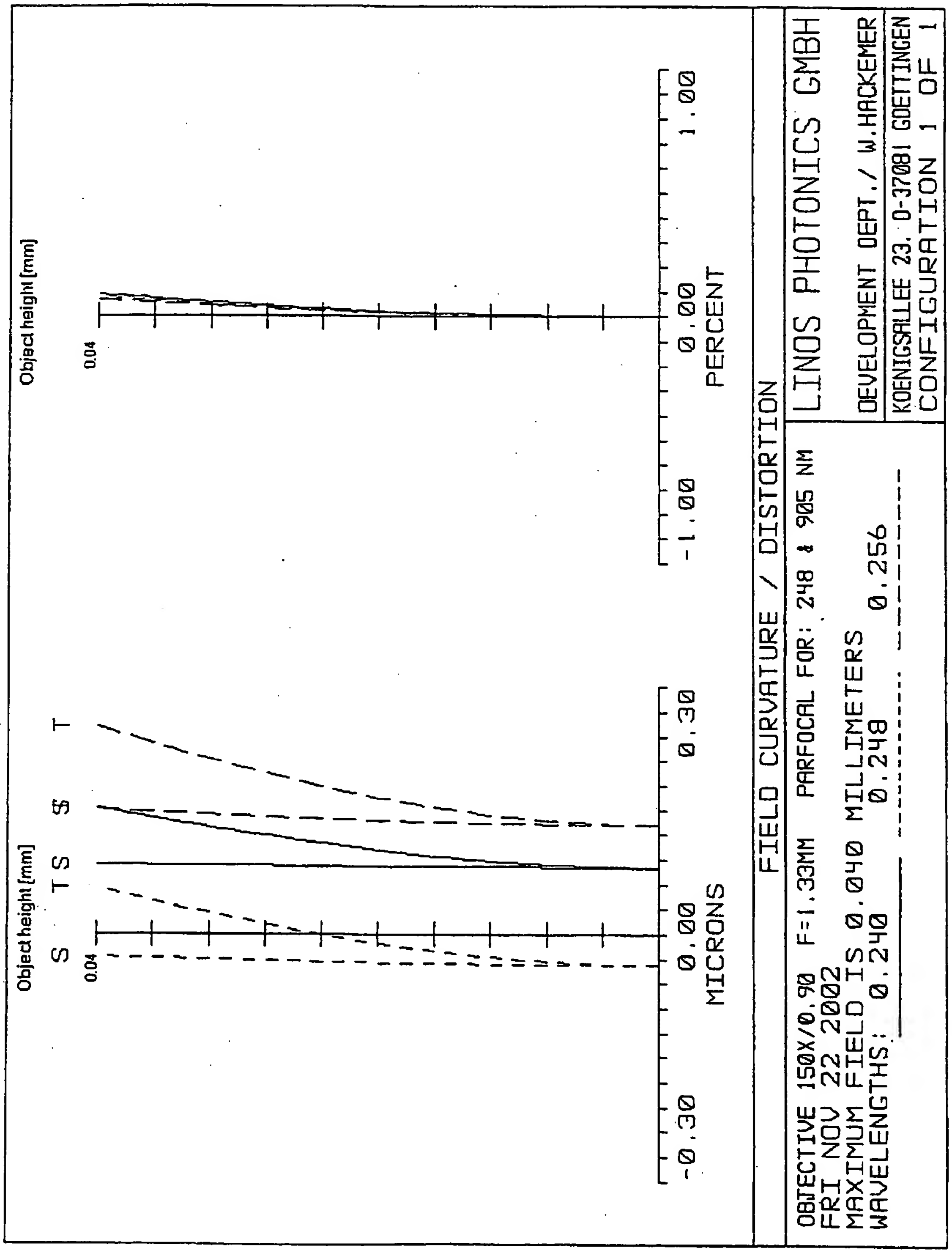
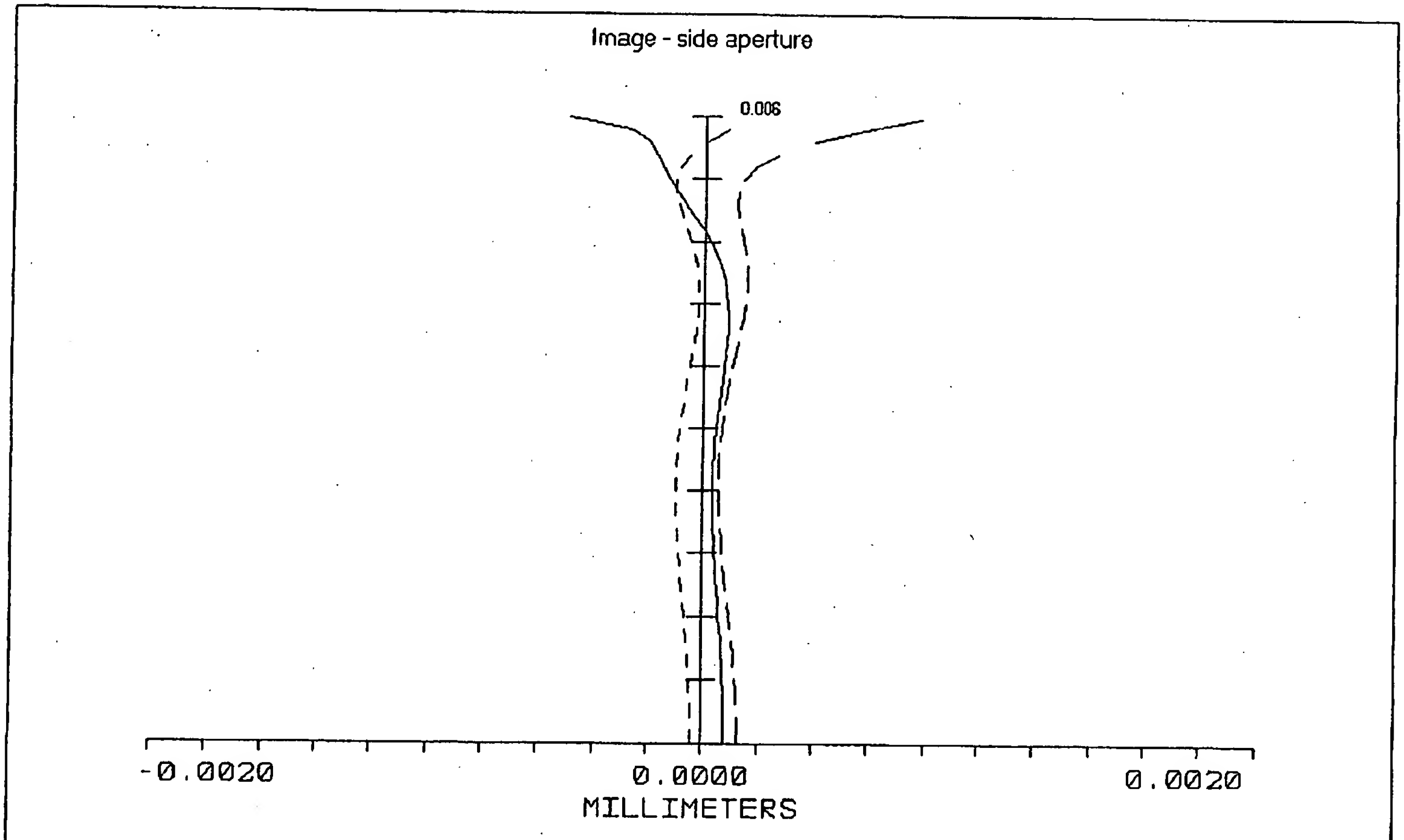

Object height [mm]
0.04
S T S
S
T
0.00
MICRONS
-0.30
0.30
Object height [mm]
0.04
0.00
PERCENT
-1.00
1.00
FIELD CURVATURE / DISTORTION
OBJECTIVE 150X/0.90 F=1.33MM PARFOCAL FOR: 248 & 905 NM
FRI NOV 22 2002
MAXIMUM FIELD IS 0.040 MILLIMETERS
WAVELENGTHS: 0.240 0.248 0.256
LINOS PHOTONICS GMBH
DEVELOPMENT DEPT./ W.HACKEMER
KOENIGSALLEE 23, D-37081 GOETTINGEN
CONFIGURATION 1 OF 1

Fig. 16b.

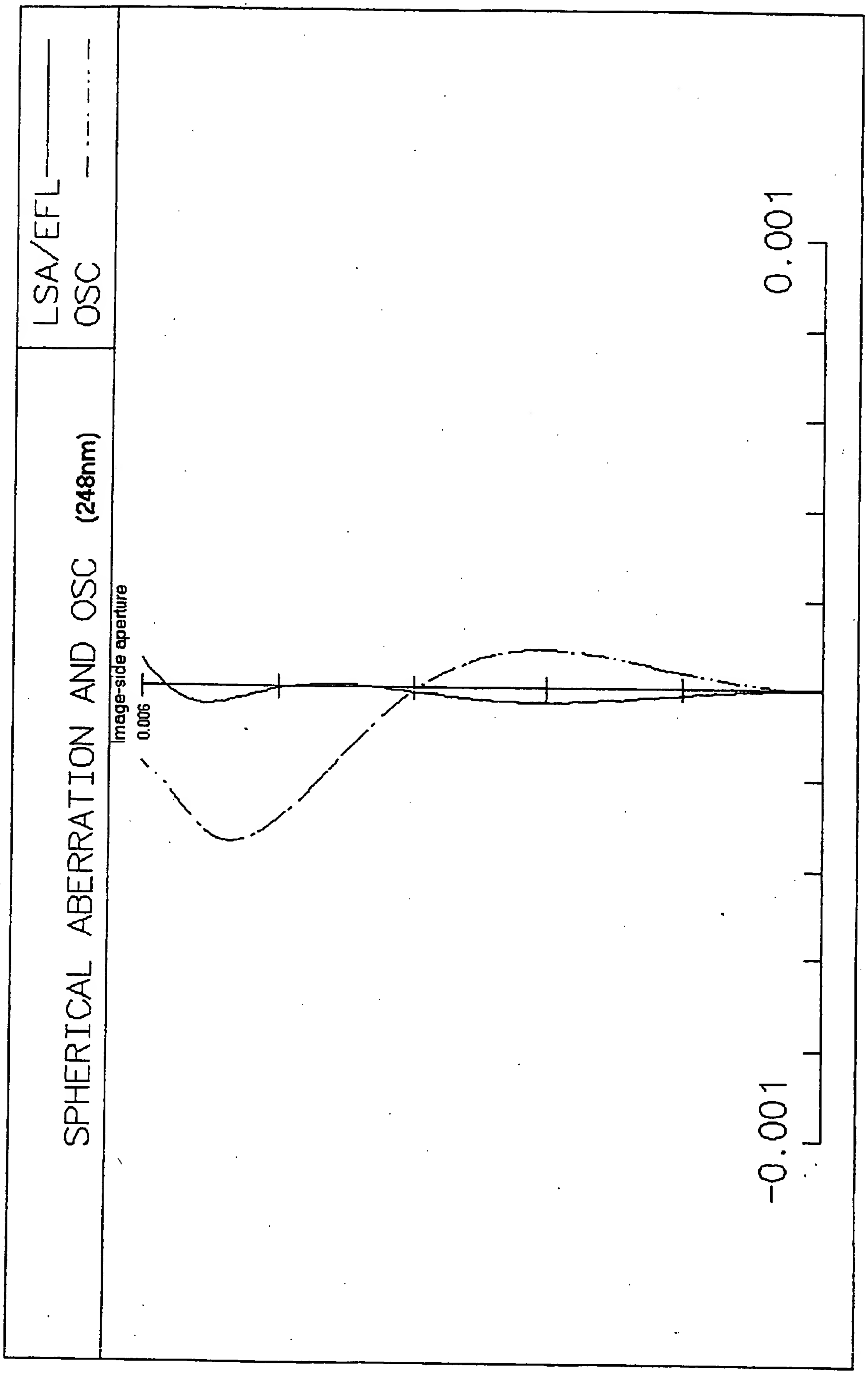


LONGITUDINAL ABERRATION

OBJECTIVE 150X/0.90 F=1.33MM PARFOCAL FOR: 248 & 905 NM
FRI NOV 22 2002
WAVELENGTHS: 0.240 0.248 0.256

LINOS PHOTONICS GMBH
DEVELOPMENT DEPT./ W.HACKEMER
KOENIGSALLEE 23, D-37081 GOETTINGEN
CONFIGURATION 1 OF 1

Fig. 16c.


SPHERICAL ABERRATION AND OSC (248nm)
LSA/EFL
OSC
Image-side aperture
0.006
0.001
-0.001

Atty. Dkt. No. 016790-0398

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Gerhard HOPPEN

Title: DUV-CAPABLE MICROSCOPE OBJECTIVE WITH PARFOCAL IR FOCUS

Appl. No.: 09/598,406

Filing Date: 06/21/2000

Examiner: A. Chang

Art Unit: 2872

DECLARATION OF DAGMAR ELVERS

Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

Sir:

I Dagmar Elvers hereby declare as follows:

1. I am a member of the Patent and Trademark Department of Leica Microsystems and I am making this Declaration in connection with the above-identified application. My technical background is in physics and in particular optics.

2. A commercial embodiment of the invention described in the above-identified application was sold under the product name Leica LWM 250 DUV. The LWM 250 DUV is a line width measurement system having a microscope which has an objective as shown in Figure 4 and as detailed in Figure 8 of the above-identified application. A copy of the sales brochure for the LWM 250 DUV, as well as the specifications and acceptance tests for the LWM 250 DUV are enclosed herewith as Exhibits 1 and 2.[1]

[1] The specifications and acceptance tests in Exhibit 2 were the specification and acceptance tests used for the sale of the LWM 250 DUV to FEI Company, referred to in paragraph 4 below.

3. As indicated by the sales brochure (page 2) and the specifications (page 15), the LWM 250 DUV uses a 248 nm DUV imaging beam and a 904 nm IR automatic focusing beam. The LWM 250 DUV thus requires a focal point at 248 nm (to produce images of a specimen) and at 904 nm (to provide automatic focusing).

4. An LWM 250 DUV was sold to a customer, FEI Company, and the customer supervised and observed testing by Leica personnel to confirm that the microscope met all requirements, including providing acceptable images at 248 nm and automatic focusing using 904 nm IR light. A copy of the test report (with handwritten translations) is enclosed as Exhibit 3. As indicated in the test report, on page 4, at position 5, a "150 DUV" objective is provided. This terminology means a 150 times objective that operates at 248 nm. On page 3, the customer has signed the report, indicating that the microscope operated satisfactorily and was accepted.

5. Section 3.7.5 documents testing to confirm that the 248 nm image is clear and that the 904 nm automatic focusing system operated satisfactorily. In this testing, the operator viewed certain standardized substrates which contain various patterns (for example, fine lines) using different objectives (250x to 5x, including the 150 times DUV objective).[2] The standardized substrates have different reflectivity (96% to 1%). All combinations of the different objectives and the different substrates were tested. If the image was clear for a particular objective and substrate, a zero was placed in the corresponding block in section 3.7.5. If the 248 nm image is clear, this means that both the 248 nm imaging beam and the 904 nm autofocusing beam have the same focal point. Thus, the zeros in the chart in the 150x row of section 3.7.5 indicate that the 248 nm imaging beam and the 904 nm autofocusing beam had the same focal point with the 150 times DUV objective, for all different substrates. The other objectives were tested with visual light illumination and a 904 nm autofocusing beam.

6. In section 3.7.6, the checkmarks indicate an acceptable image and acceptable autofocusing after an objective was changed (for example, from a 5x objective to a 10x objective).

[2] All of the objectives except for the 150 times DUV objective are for visual light illumination with 904 nm autofocusing.

7. Accordingly, a commercial model having a 150 times DUV objective (according to thc invention described in the above-identified patent application) had the same focal point for both 248 nm DUV light and 904 nm IR light.

8. I further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

February 5, 2004
Date

Dagmar Elvers
Dagmar Elvers

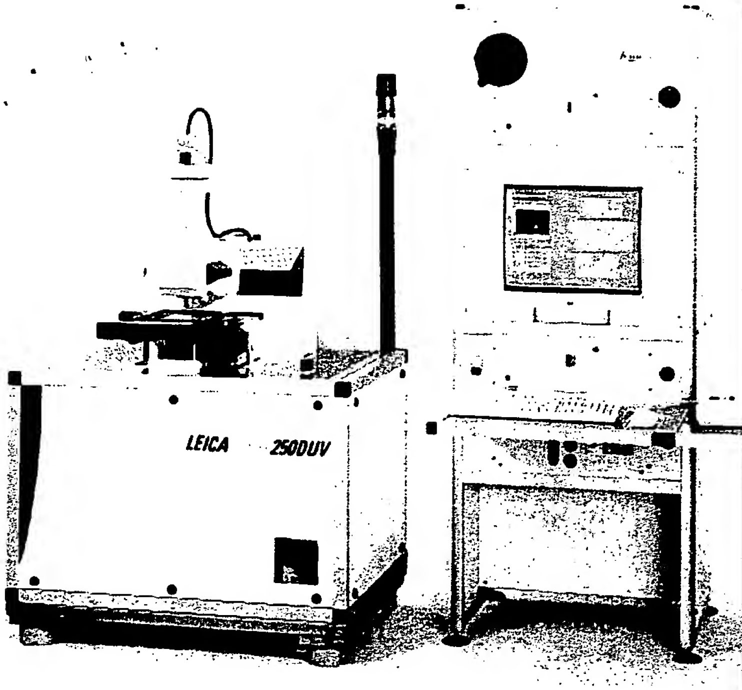


EXHIBIT 1

Leica LWM250 DUV

Automatic mask CD measurement system
with DUV technology

Leica
MICROSYSTEMS

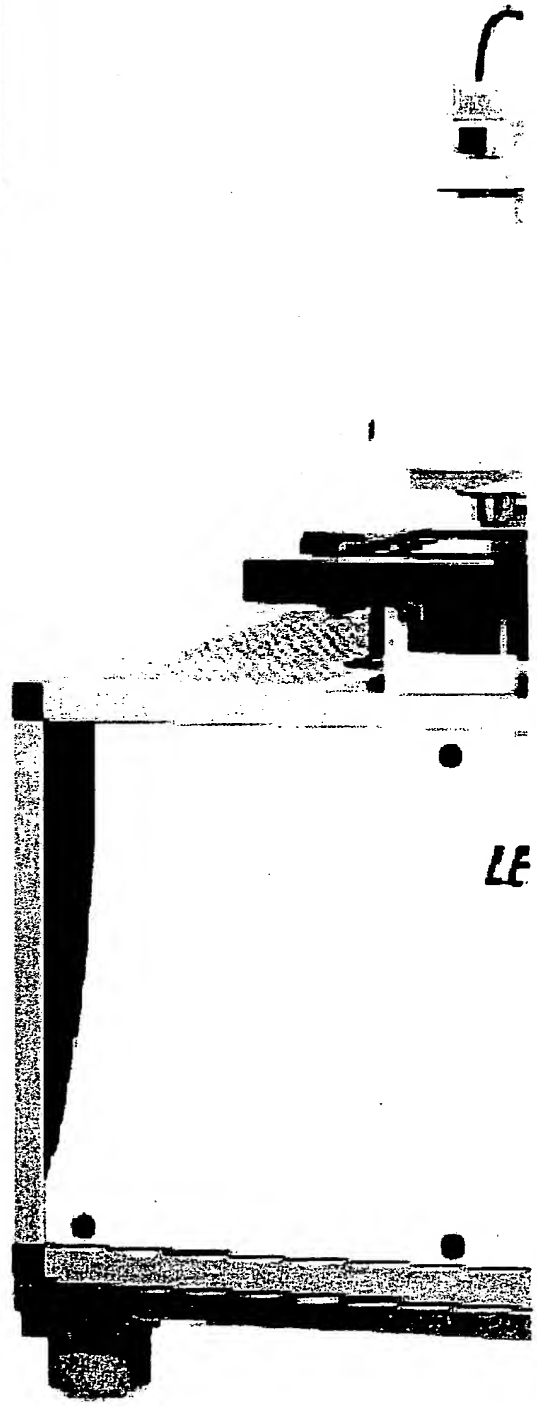
1

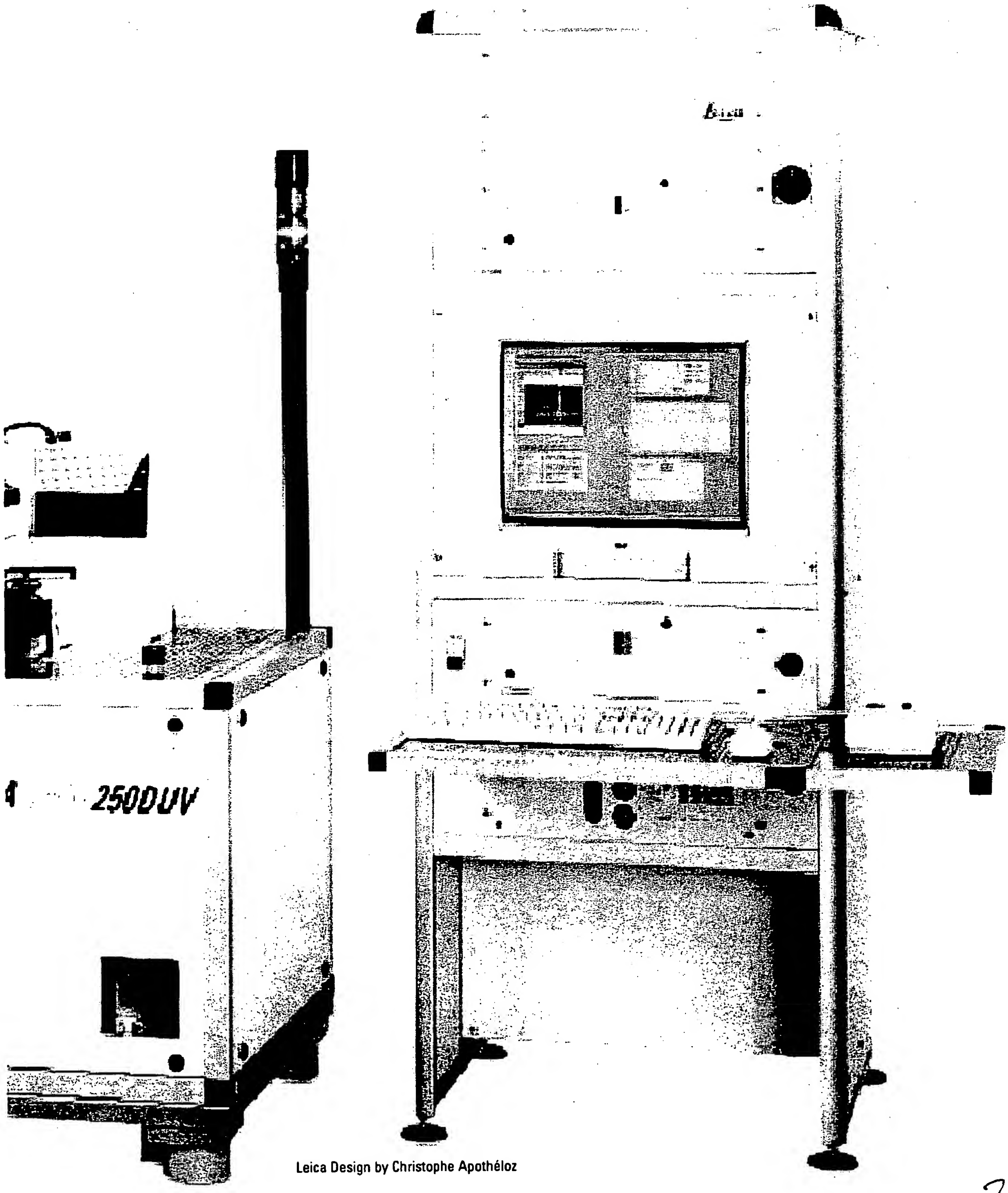
Leica LWM250 DUV

Leica LWM250 DUV was designed to meet the evolving technological requirements of the photomask industry. Our high-resolution 248 nm deep ultraviolet (DUV) optics allow accurate measurements of features as small as 0.2 microns. A variety of mask sizes and types can be measured in transmitted and reflected illumination modes. The LWM250 DUV's high precision scanning stage allows for accurate measurements on masks as large as 7 inches in size.

The LWM250 DUV is the result of an evolutionary process beginning with the LWM200 and progressing through the I-line spectrum of the 365-nanometer measurement wavelength (LWM250 UV) to the current 248-nanometer wavelength. This means higher resolution and measurement accuracy achieved by each step. Leica Microsystems unique patented optics system allows for automatic laser auto-focussing in combination with DUV optics. This means fast critical dimension (CD) acquisition time and throughput.

An advanced Windows NT 4.0™ graphical user interface allows for a flexible job set-up and system operation. Job set-up information can be input via Leica's LMS MF2/MF3 input formats or via ASCII scripts. It is also possible to download defect detection files from various vendors for defect classification, review, and analysis. Additionally, Leica offers an optional aerial image simulation package for evaluation of defect printability at the 248-nanometer wavelength.

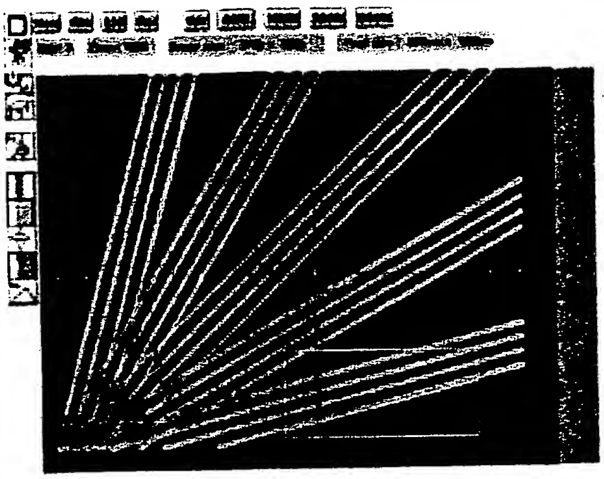




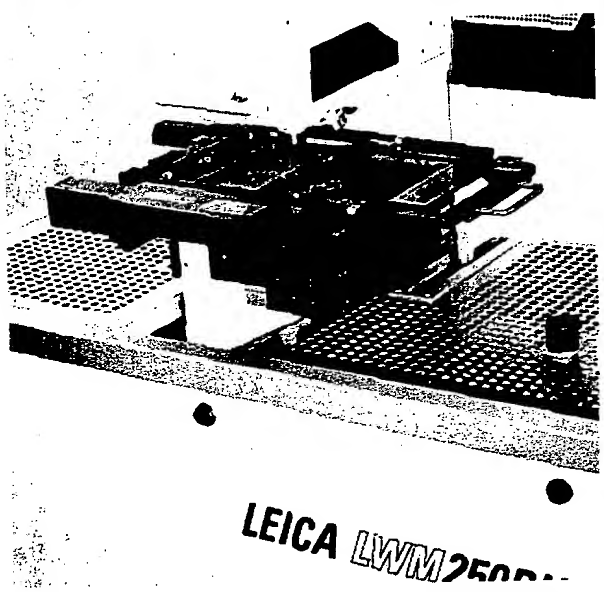
Leica Design by Christophe Apothéloz

3

The LWM250 DUV system features



CD measurement capability at any orientation



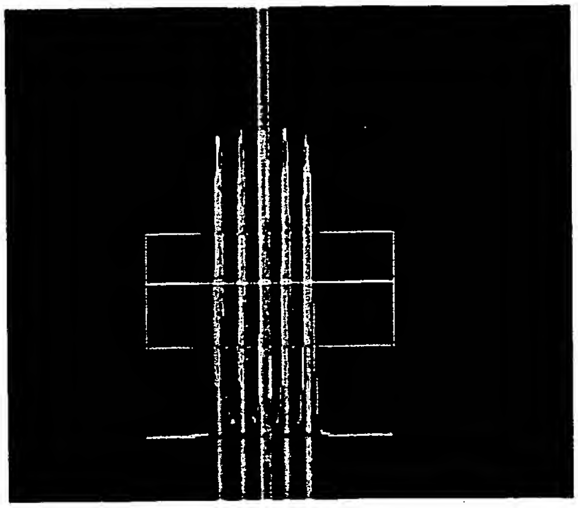
Secure and convenient mask loading by sliding maskholder loading system

$$\Delta x = k \frac{\lambda}{NA}$$

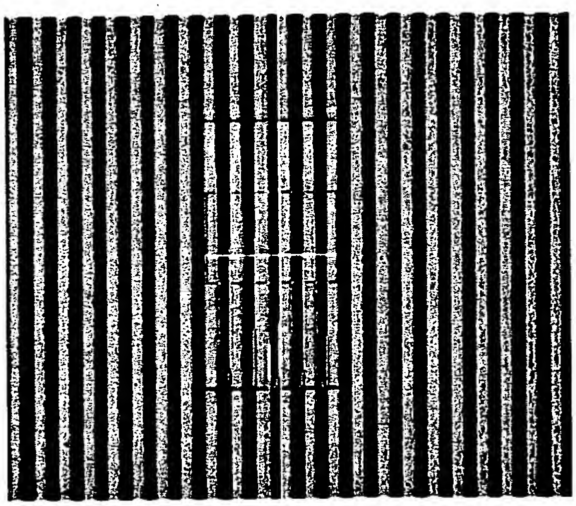
- DUV measurement illumination in transmitted light and incident white light illumination for orientation and mask alignment
- Programmable and fully automatic selection of illumination modes and condenser positioning
- Measurement of CD's on binary, OPC, and Phase Shift Masks
- A high precision scanning stage
- Laser and TV auto-focussing for fast and accurate measurements
- The Windows 4.0™ based graphical user interface software allows easy job set-up and operation
- Measurement sites X/Y coordinate transfer via ASCII and MF2/MF3 file format
- Downloading of defect coordinates from defect detection systems for classification, analysis and after repair verification
- An optional defect printability simulation software package at 248-nanometer wavelength

Leica Microsystems has a long history of manufacturing high quality optical systems for inspection and measurement of various substrate types. The LWM250 DUV is our current "state of the art" offering. The 248 nm fully corrected DUV optics come close to the theoretical limits for resolution. Combining these optics with laser auto-focus capability results in CD throughput at approximately 6 seconds or better per x/y site, measure-acquire-measure time (MAM). For measurement of photomask substrates this means that the LWM250 DUV can be 5 to 10 times faster than competitive systems. This feature becomes more valuable as the number of CD measurements increases due to continually tightening manufacturing tolerances.

Leica's commitment to our customers is to focus on the applications support as well as continuously improve software and hardware. Our partnership with key customers and technology leaders helps us to understand the evolving needs of the photomask industry. Our goal is to maintain a leadership role in the photomask metrology market by providing our customers with solutions and support resulting in a high degree of customer satisfaction.



Intensity profile of submicron lines and spaces



CD measurement of submicron chromium line

There are two software modes incorporated into the system. The first mode referred to as the Macro Programming mode allows for very flexible and versatile system operation. Many different types of conditions and features may be evaluated using a single macro. Some examples of system versatility include measurement and evaluation of edge roughness, corner rounding, contacts, memory cells and line edge shortening. Virtually every parameter on the system may be controlled via the macro script language. This is especially useful in an engineering or R&D environment. The second mode called LMP (Linewidth Measurement Program) is designed for production work. It allows for operators with minimum training to quickly and efficiently perform routine measurement tasks. The combination of these two capabilities in a Windows NT 4.0 environment make the LWM250 DUV one of the most sophisticated and easy to use CD systems available today.

In an inspection mode features as small as 100 nm are resolvable with the DUV wavelength. This allows photomask manufacturers and users to evaluate and inspect features optically that previously could only be seen with scanning electron microscopes (SEMs). This high-resolution capability without the detriments of charging, pump down times, and throughput loss means users can quickly inspect OPC features.

Specifications:

Minimum line width:	0.2 µm (DUV transmitted light)
DUV (248 nm) illumination:	
Long term repeatability:	≤ 3 nm (3 sigma) on Leica CD test mask
(0.2 µm – 7 µm, XY-Direction)	≤ 4 nm (3 sigma) on chrome final and etched mask
Measuring time:	
manual mode:	≤ 6 seconds (typ.)
automatic mode*	≤ 15 seconds (typ.)
Screen XY measurement area (PL APO 150/0.90 DUV obj.):	10 x 7.5 µm²
Screen Linearity*:	≤ 10 nm range
Motorised stage size:	6″ x 6″ (152 mm x 152 mm)
Mechanical accuracy with software correction:	≤ 4 µm
Repeatability:	≤ 2 µm
Maximum speed:	≤ 20 mm/sec
Cleanliness:	class 1 compliant microscope

* Typical performance, depending on the measurement parameters, edge quality and substrate materials

Leica Microsystems – the brand for outstanding products

Leica Microsystems' mission is to be the world's first-choice provider of innovative solutions to our customers' needs for vision, measurement, lithography and analysis of microstructures.

Leica Microsystems, the leading brand for microscopes and scientific instruments, developed from five brand names, all with a long tradition: Wild, Leitz, Reichert, Jung and Cambridge Instruments. Yet Leica symbolizes innovation as well as tradition.

Leica Microsystems – an international company with a strong network of customer services

Australia:	Gladesville	Tel. +61 2 9879 9700	Fax +61 2 9817 8358
Austria:	Vienna	Tel. +43 1 486 80 50 0	Fax +43 1 486 80 50 30
Canada:	Richmond Hill/Ontario	Tel. +1 905 762 2000	Fax +1 905 762 8937
Denmark:	Herlev	Tel. +45 4454 0101	Fax +45 4454 0111
France:	Rueil-Malmaison Cedex	Tel. +33 1 473 285 85	Fax +33 1 473 285 86
Germany:	Bensheim	Tel. +49 6251 136 0	Fax +49 6251 136 155
Italy:	Milan	Tel. +39 0257 486.1	Fax +39 0257 40 3273
Japan:	Tokyo	Tel. +81 3 5435 9600	Fax +81 3 5435 9618
Korea:	Seoul	Tel. +82 2 514 65 43	Fax +82 2 514 65 48
Netherlands:	Rijswijk	Tel. +31 70 4132 100	Fax +31 70 4132 109
Portugal:	Lisbon	Tel. +351 21 388 9112	Fax +351 21 385 4668
Republic of China:	Hong Kong	Tel. +852 2564 6699	Fax +852 2564 4163
Singapore:		Tel. +65 779 7823	Fax +65 773 0628
Spain:	Barcelona	Tel. +34 93 494 95 30	Fax +34 93 494 95 32
Sweden:	Sollentuna	Tel. +46 8 625 45 45	Fax +46 8 625 45 10
Switzerland:	Glattbrugg	Tel. +41 1 809 34 34	Fax +41 1 809 34 44
United Kingdom:	Milton Keynes	Tel. +44 1908 246 246	Fax +44 1908 609 992
USA:	Bannockburn/Ilinois	Tel. +1 847 405 0123	Fax +1 847 405 0164

and representatives of Leica Microsystems in more than 100 countries.

The companies of the Leica Microsystems Group operate internationally in five business segments, where we rank with the market leaders.

Microscopy

Our expertise in microscopy is the basis for all our solutions for visualization, measurement and analysis of microstructures in life sciences and industry.

Specimen Preparation

We specialize in supplying complete solutions for histology and cytopathology.

Imaging Systems

With confocal laser technology and image analysis systems, we provide three-dimensional viewing facilities and offer new solutions for cytogenetics, pathology and material sciences.

Medical Equipment

Innovative technologies in our surgical microscopes offer new therapeutic approaches in microsurgery. With automated instruments for ophthalmology, we enable new diagnostic methods to be applied.

Semiconductor Equipment

Our automated, leading-edge measurement and inspection systems and our E-beam lithography systems make us the first choice supplier for semiconductor manufacturers all over the world.

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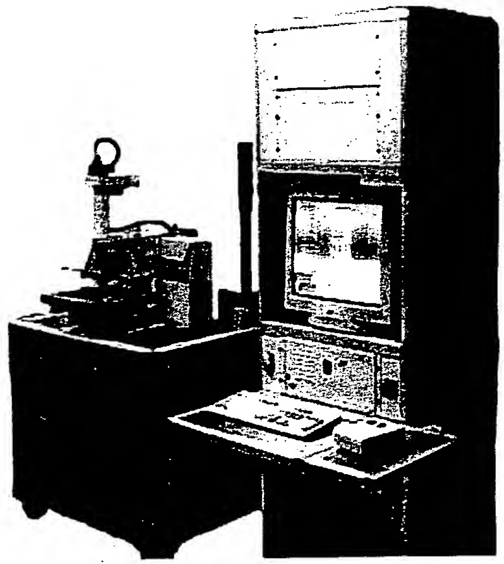
Leica
MICROSYSTEMS

EXHIBIT 2



LEICA
LWM 250 DUV

Preliminary Version

Specifications and Acceptance Tests for the Line Width Measurement System

January 08, 2001

Leica

1

Leica MICROSYSTEMS

Leica Microsystems Wetzlar GmbH
Technical Service Semiconductor Equipment
Ernst-Leitz-Straße
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Fax +49 (0) 6441 / 29 - 22 46

Order no. of this edition:

2

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System Information

System: ____________________

Order no.: ____________________

Serial no.: ____________________

Manufacturer:

Leica Microsystems Wetzlar GmbH
Ernst-Leitz-Straße
Postfach 2040
35530 Wetzlar
Phone (+49(0)6441 / 29-0
Fax (+49(0)6441 / 29-2246
E-mail:100437,2210@Compuserve.com

Certification of factory acceptance

The system named above with its modular assemblies has been inspected with regard to the specifications in the enclosure and left the factory in a perfect condition.

Date: ____________ Tested by: ____________________

Certification of installation and start-up

System start-up was carried out by TS-MEL resp. Sales Company: ____________________

Customer: ____________________

Dept.: ____________________

Tel.: ____________________

Address: ____________________

User: ____________________

The system named above was installed and put into operation. The specifications in the enclosure have been proved.

Date: ____________ TS-MEL/Sales Company: ____________________

5

Certification of customer acceptance

The system has been delivered completely according to the delivery note. All acceptance test procedures were carried out and the results were:

fully O
partly O
not O
in tolerances

Deviations:____

____

____

The system is finally accepted:

Date: ________________ **Customer:**____________________

The system was not accepted due to the following reasons:____________________

____

____

Date: ________________ Customer:________________________

Beginning of warranty

The beginning of the warranty period is herewith confirmed:

Date: ________________

TS-MEL/Sales Company:________________ Customer:____________________

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System Configuration

Leica Order no. : ______________________ Serial no.: ________________

Customer ID : ____

Hardware

Microscope : Type:____________________ # no.:__________________

Objectives : Pos.1:_________ Pos.2:_________ Pos.3:_________

: Pos.4:_________ Pos.5:_________ Pos.6:_________

Opt. accessories : ____

O- tube : Type:____________________ # no.:__________________

Sliding mask holder: Type:____________________ # no.:__________________
Loading system

Mask holder : Type 1:_________ Type 2:_________ Type 3:_________

: Type 4:_________ Type 5:_________ Type 6:_________

LFS-module : Type:____________________ # no.:__________________

Beam splitter : Type:____________________ # no.:__________________

Lamphouse, vis. : Type:____________________ # no.:__________________

Lamphouse, DUV : Type:____________________ # no.:__________________

Notch filter : Type:____________________ # no.:__________________

Hg/Xe supply : Type:____________________ # no.:__________________

Mot. condensor : Type:____________________ # no.:__________________

Measuring cam. : Type:____________________ # no.:__________________

Alpha unit : Type:____________________ # no.:__________________

Scanning stage : Type:____________________ # no.:__________________

Stage controller : Type:____________________ # no.:__________________

X/Y/Z Box : Type:____________________ # no.:__________________

7

Computer and accessories

Measurement controller: Type:______________ # no.:________________

Operating system

DOS ver.: ____________ **Win ver.:** ____________

Mother board: ____________ **Memory:** ____________

Bios ver.: ____________ **Date:** ____________

HD-type:___________________________

Cyln. : _____ Head : _____ WPcom : _____
L-Zone : _____ Sect. : _____ Size : _____ Mode: _____

Floppy: ☐ **CD-ROM:** ☐ **Zip drive:** ☐

Keyboard no. : Type:______________________ # no.:____________________

Mouse/Track ball : Type:______________________ # no.:____________________

Monitor : Type:______________________ # no.:____________________

Printer : Type:______________________ # no.:____________________

NT-Ntework-PC: Type:______________ # no.:________________

Operating system

DOS ver.: ____________ **Win ver.:** ____________

Mother board: ____________ **Memory:** ____________

Bios ver.: ____________ **Date:** ____________

HD-type:___________________________

Cyln. : _____ Head : _____ WPcom : _____
L-Zone : _____ Sect. : _____ Size : _____ Mode: _____

Floppy: ☐ **CD-ROM:** ☐ **Zip drive:** ☐

Keyboard no. : Type:______________________ # no.:____________________

Monitor : Type:______________________ # no.:____________________

Media Controller : Type:______________________ # no.:____________________

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Software

Leica **LWM250DUV** Software, Measurement-Controller
Application software
Version:_________ Date:_________

Leica **LWM250DUV** Software, NT-Controller
NT-terminal software
Version:_________ Date:_________

Firmware/Eproms in System

Microscope:

Master :_____________________________

Basic :_____________________________

LZAM :_____________________________

ICR :_____________________________

Stage controller :_____________________________

Consumable parts

The parts listed below are consumable parts with the indicated lifetime (operation conditions 24hrs, 7days/week).

Part	Lifetime approx.	Order no.
Halogen lamp 12V/100W	>=4 weeks	11 700 066
HBO/XBO lamp 100W Hamamatsu L8029 Mercury/Xenon	>=6 weeks	11 700 075
Ushio UXM-S100ZS	>=6 weeks	11 700 076

The lamps can be ordered as usual via Leica´s TS-Logistic, Wetzlar.

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Documentation

The following documentation will be supplied with every system:

Documentation	Quantity
LWM Operation Manual	☐
Windows Operation Manual	☐
Hardware Manual *LWM 250 DUV*	☐
Software Manual	☐
Computer Manuals	☐

Service manual will be supplied in combination with service training only.

Safety notes

Electrical safety

A safety test according to EN 61010-1 has been carried out for each component connected to the mains and for the entire system. All requirements of the safety test were met.

Electromagnetic Compatibility

The electromagnetic compatibility of the system is in accordance with EN 50081-2, EN 50082-2.

Laser safety

The instrument is a Class I Laser product in accordance with the following regulations:
IEC825-1 : 1993
EN 60825-1 :1994
VBG 93 (1988, BRD)
21 CFR 1040 (1985, USA)

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Technical data

This section contains information on specifications of the system.
Data in part ***"Specifications to be demonstrated"*** are demonstrated with the test procedures in the section

"Test and Acceptance procedures".

Data in part ***"Certified specifications"*** are certified with this data sheet.

Data mentioned as ***"Typical performance"*** have been obtained on customer masks during evaluation. Guaranteed specifications on customer masks can be supplied only after sample evaluation by Leica Microsystems Wetzlar.

The following is a list of Leica test standards, techniques and external data sheets:

- SEMI standards: SEMI M1.10.92, M15-89, M1.6-89, M1.7-89, M1.8-89, M1.9-91, M1.10-92, M1.11-90, M1.12-90, M1.13-90
- Admissible floor vibration spectrum
- Leica CD testmask

All information is based on the measurement and analysis parameters of section ***Test and Acceptance Procedures***.

Specifications to be demonstrated

Measuring system LWM

- **DUV-Line long term repeatability:**

  3 sigma; <= 3nm on Leica CD testmask (structures lines/spaces 0.3µm...4.6µm)

The test procedures are described on page B-16.

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Certified specifications

Measuring system LWM 250 DUV

Basic specifications

	DUV measurement
Screen X/Y measurement area (objective 150x)	10µm x 7,5µm
Screen linearity (objective 150x)	<=10nm
Measuring time manual mode (typical performance)	<=5s
Measuring time automatic mode (typical performance)	<=15s

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Typical performance
Data mentioned under this paragraph (*"Typical performance"*) have been obtained on customer masks during evaluation. Guaranteed specifications on customer masks can be supplied only after sample evaluation by Leica Microsystems Wetzlar!

Minimum line width	**DUV measurement**
Minimum line width w/o pellicle ASI (transmitted light)	0.2µm
Minimum line width with pellicle ASI, transmitted light	n.a.
Minimum AEI line width transmitted light	0.2µm

Chrome/Glass masks	**DUV measurement line widths of 0.3-4.6µm**
Short term repeatability AEI transmitted light	t. b. d.
Short term repeatability ASI transmitted light, excellent edge quality, typical performance	3nm (3 sigma)
Long term repeatability AEI transmitted light	t. b. d.
Long term repeatability ASI transmitted light, excellent edge quality, typical performance	3nm (3 sigma)

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Pelliclized chrome/glass masks	DUV measurement
Short term repeatability pelliclized ASI transmitted light, excellent edge quality, typical performance	n. a.
Long term repeatability pelliclized ASI transmitted light, excellent edge quality, typical performance	n. a.

Half tone phase shift masks	DUV measurement line widths of 0.3-10µm
Short term repeatability HT PSM ASI transmitted light, excellent edge quality, typical performance	t. b. d.
Long term repeatability HT PSM ASI transmitted light, excellent edge quality, typical performance	t. b. d.

Safety data:

- Ground conductor resistance = < 0.1 Ohm
- Insulation resistance = > 10 MOhm
- High-voltage test = < 1.2 kV

Reliability data:

- MTBF* = > 1000h** (***)
- MTTR* = < 4h**

* = according to SEMI GUIDELINE EQUIPMENT RELIABILITY E10-92
** = can only be guaranteed by the local LEICA Agency.
*** = except light bulbs, high pressure lamps and other consumables.

Clean room class compatibility: = < 10

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Microscope

Objective nosepiece:	=	<1s, time required to switch an objective to adjacent position sixfold objective nosepiece with 4 centerable objective positions.
Focus drive:	=	motorized with 18nm resolution
Aperture diaphragm: Reflected light only	=	motorized 5 pos. diaphragm revolver automatically matched to objectives used
Field diaphragm: Reflected light only	=	motorized, automatically matched to illumination mode used
Autofocus:	=	Laser Autofocus (LFS) - Wavelength of laser diode: 904nm - Focusing with objectives 5x, 10x, 20x, 40x, 50x, 100x, 150x, on materials with 1%...96% reflection
Optical Resolution :		better than 0.2 µm line width using adequate high performance objective (high magnification, high aperture) on a grid structure.

Scanning stage (preliminary)

Scanning stage for sample size: 6"

- Stage position repeatability: <3µm (3s)
- Stage accuracy <4µm (3s)
- Travel range 152 mm x 152 mm (incident light mode)
- Planarity of sample holder <30 µm
- Maximum speed > 50 mm/s
- Maximum stage load = 2kg (incl. sample holder)
- Resolution = 0.5 µm
- Max. sample thickness <29mm (without sample holder)
- Orthogonality 22µm/150mm

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Tests and acceptance procedures

Test conditions

- Operating temperature 18°C - 25°C (64°F-77°F)
- Measuring temperature 22°C (72°F, +/-2°F)
- Temperature stability +/- 0.5°C
- Relative humidity =<75%, +/-1%
- Proper installation and adjustment by authorized personnel
- Minimum operating time 24h
- Hard/software calibrations are carried out accurately
- Floor vibrations as per admissible vibration spectrum
- Vacuum supply <200hPa
- Airpressure: Pmin=5bar; Pmax=10bar
- Power supply: 115 / 230 Volt , +/- 10% , 50/60 Hz

Test procedures

Measuring system LWM

- **DUV long term repeatability:**
  The following macros have to be used:
  ACCX_DUV.MAC ;CD measurement in X-direction
  ACCY_DUV.MAC ;CD measurement in Y-direction

1. The test is related to the Leica CD testmask which is delivered with the system.
2. The acceptance test is repeated 3 times during at least 2 days. Each day the test job is loaded and executed on the Leica CD Testmask. The measurement jobs move the Testmask to the measurement positions and the CD-structure is measured automatically.
3. The measurements are carried out in the 0^0 and 90^0 orientation of the mask
4. Up to 14 CD structures (lines/spaces 0.3; 0.5; 0.7; 1.1; 2.2; 3.2; 4.6µm) are measured 30 times in a loop.
5. The results have to be stored in the database-window when the acceptance test run is finished
6. The database-file contains the calculated repeatability results. The 3 sigma value of all three days with 30 loops each are the ones.

16

Test Results

Serial No.:___________

Specification System	Value	Acceptance Test Leica Wetzlar	Acceptance Test Customer site
Measurement system LWM			
Long term repeatability X i-Line (3sigma)	3nm	________________	________________
Long term repeatability Y i-Line (3sigma)	3nm	________________	________________
Signatures		Date:____________ Name:___________	Date:____________ Name:___________

17

Additional system tests and checks

Installation system tests

During installation procedure the following additional tests are carried out:

- Homogeneity check of illumination
- Stage repeatability

Please find an ***Example*** of these tests on the next pages! A print out or screen shot of the mask is carried out and completes this document!

System setup and configurations

During installation procedure the following system setup and configuration measures are carried out:

- LFS offset check
- Lens positions
- Configuration stage window
- Holder (position of center cross of test mask)
- Z-values of all objectives
- Config window

Please find an ***Example*** of these setup and configurations on the next pages! A print out or screen shot of the mask is carried out and completes this document!

18

Example Acceptance Test Protocol

To be prepared

19

Example Screen homogeneity

To be prepared

20

Example Stage repeatability

To be prepared

21

Example LFS offset check

To be prepared

Example Lens positions

To be prepared

Example Configuartion stage window

To be prepared

22

Example Holder

To be prepared

Example Z-values

To be prepared

23

Example Config window

To be prepared

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EXHIBIT 3

this copy contains handwritten translations!

D. Plummer

Leica Microsystems Semiconductor GmbH
Ernst-Leitz-Straße 17-37
D-35578 Wetzlar
UST/VAT-No. DE 811141431

Delivery note

No.: 80148784

Page: 1 of 1

Date: 11/16/2001

Shipping date: 11/13/2001

29 JAN 04 (date of translations)

Leica Microsystems Semiconductor GmbH, Postfach 2040, D-35530 Wetzlar

FEI Company
Micrion Product Division
10 Technology Drive
PEABODY MA 01960
USA

15.11.01

Your ref. no.:	5630095895
Date:	10/10/2001
Cust. ref.:	0013090703

Contact:	Herr Herrmann
Department:	V-MEL
Telephone:	+49 06441/292329
Fax:	+49 06441/292276
E-mail:	thomas.herrmann@leica-microsystems.com
Confirmation:	117728

Item	Description	Storage place	Ordered	Delivered	Open qty.
0010	LWM250 DUV CD Measurement System Material number 11100897 Country of origin: DE Serial number: 7014	4119	1	1 PC	0

Sold-to address:
Leica Microsystems Inc.
SEG
2345 Waukegan Road
BANNOCKBURN IL 60015
USA

Weight:	750 KG
Number of packages:	
Markings:	M32072
Shipping type:	Air Freight
Werkstattanleitung	Achtung!!! gem. NRTL-Richtlinien modifizieren!!!

****

workshop instruction → Attention!!! modify according to NRTL-requirements

In case of any queries or comments please indicate the delivery note number and date. Thank you.

With best regards
Leica Microsystems Semiconductor GmbH

Packing List LWM250DUV

Order No. : 117728 FEI USA

Box	Content	Amount	checked
G	Base frame	1	✓
R	Rack	1	✓
	PC-keys	4	✓
	back door	1	✓
	caster	2	✓
Z	Bag with assembling parts	1	✓
	Screws for scanning stage	4	✓
	Mikroscope parts		✓
	Allen keys	1	✓
	Screws for Sliding System	4	✓
	Screws for lamp alignment tool	2	✓ Base frame
	Label set		✓
	Spare fuses		✓
	Connection parts		✓
	Cable ties		✓
	Screws for keyboard table	4	✓
	Box with accessories		
enter amount !	Mask holder	1	6025 ✓
	Notchfilter	1	✓
	Mouse	2	✓
	Keyboard for network computer	1	✓
	Backup-CD's	3	✓
	DUV-Lamps	2	2 ✓
	Halogen lamps	10	10 ✓
	Signal tower + column	1	✓
	Test mask	1	✓
	Earthquake protection	3	✓
	Scanning stage	1	✓
	O-Tube + Alfa + Camera	1	✓
	Support table for camera controller	1	✓
	Camera controller	1	✓
	Camera controller cable	3	✓
	Lamp cover	1	✓
	Sliding system	1	✓
	Frame for lamp power supply	1	✓
	Lamp power supply LEJ EBQX	1	✓
	Lamp house LH200 DUV	1	✓
	Lamp house LH 106 Z	1	✓
	Lamp alignment tool	1	✓
	Keyboard table	1	✓
	Joystick	1	✓
	Keyboard for measurment controller	1	✓
	Monitor	1	✓
check Ser. No. !	Dokumentation PC's	1	✓
	Software manual	1	✓ 1 an Kunde direkt
	Hardware manual	2	✓
	CE declaration for EU customer	1	–
	DUV-objective	1	✓
	Safety eyewear	1	✓

Systems comprises DUV components!

directly to customer

2

Certification of customer acceptance

The system has been delivered completely according to the delivery note. All acceptance test procedures were carried out and the results were:

fully O
partly O
not O
in tolerances

Deviations:______________________________

____

____

The system is finally accepted:

Date: 14.11.2001 Customer: ______________________________

The system was not accepted due to the following reasons: the customer's signature shows that the system was in optimal function

____

____

Date: ______________ Customer: ______________

Beginning of warranty

The beginning of the warranty period is herewith confirmed:

Date: ______________

TS-MEL/Sales Company: ______________ Customer: ______________

3

System Configuration

Leica Order no.	:	117728	Serial no.:	7014	
Customer ID	:				

Hardware

Microscope	: Type:	11761053	#no.:	122		
Objectives	: Pos.1: 2.5		Pos.2: 5		Pos.3: 10	
	: Pos.4:		Pos.5: 150 DUV		Pos.6:	
			→ No. of nosepiece position			
Opt. accessories	:					
O- tube	: Type:	11761054	#no.:	121		
Sliding mask holder: Loading system	Type:	LS 3	#no.:	52		
Mask holder	: Type 1: 6025		Type 2:		Type 3:	
	: Type 4:		Type 5:		Type 6:	
LFS-module	: Type:	11573099	#no.:	4554		
Beam splitter	: Type:		#no.:			
Lamphouse, vis.	: Type:		#no.:			
Lamphouse, DUV	: Type:		#no.:			
Notch filter	: Type:		#no.:			
Hg/Xe supply	: Type:		#no.:			
Mot. condensor	: Type:	MK1.1	#no.:	107		
Measuring cam.	: Type:	C7300-10-12 NR	#no.:	940151		
Alpha unit	: Type:	AC 6.1	#no.:	88		
Scanning stage	: Type:		#no.:	1073040		
Stage controller	: Type:		#no.:			
X/Y/Z Box	: Type:		#no.:			

LFS = Laser focussing system (autofocus)

!

4

Computer and accessories

Measurement controller: Type: PC 5.3 #no.: 483

Operating system

DOS ver.: ______ Win ver.: NT4.0

Mother board: ______ Memory: ______

Bios ver.: ______ Date: ______

HD-type: ______

Cyln. : ____ Head : ____ WPcom : ____
L-Zone : ____ Sect. : ____ Size : ____ Mode: ____

Floppy: ☒ CD-ROM: ☒ Zip drive: ☐

Keyboard no. : Type: G 81 #no.: 357

Mouse/Track ball : Type: Logitech M-S35 #no.: 10711302

Monitor : Type: Philips 201 B10 #no.: 115664295

Printer : Type: ______ #no.: ______

NT-Ntework-PC: Type: PC 5.4 #no.: 510

Operating system

DOS ver.: ______ Win ver.: NT 4.0

Mother board: ______ Memory: ______

Bios ver.: ______ Date: ______

HD-type: ______

Cyln. : ____ Head : ____ WPcom : ____
L-Zone : ____ Sect. : ____ Size : ____ Mode: ____

Floppy: ☒ CD-ROM: ☒ Zip drive: ☒

Keyboard no. : Type: G 84 #no.: 9496

~~Monitor~~ Mouse : Type: Logitech M-S35 #no.: 10711334

Media Controller : Type: MC3 R2 #no.: 205

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Software

Leica LWM250DUV Software, Measurement-Controller
Application software
Version: 405b Date:

Leica LWM250DUV Software, NT-Controller
NT-terminal software
Version: Date:

Firmware/Eproms in System

Microscope:

Master: 301 389 033 017

Basic : 201 360 041 010

LZAM : 301 389 043 012

ICR :

Stage controller : 2.61

Consumable parts

The parts listed below are consumable parts with the indicated lifetime (operation conditions 24hrs, 7days/week).

Part	Lifetime approx.	Order no.
Halogen lamp 12V/100W	>=4 weeks	11 700 066
HBO/XBO lamp 100W Hamamatsu L8029 Mercury/Xenon	>=6 weeks	11 700 075
Ushio UXM-S100ZS	>=6 weeks	11 700 076

The lamps can be ordered as usual via Leica´s TS-Logistic, Wetzlar.

ACCEPTANCE TEST PROTOCOL DUV ILLUMINATION

MZD MASK - X DIRECTION

LEICA ORDER :	117728	SERIAL NUMBER :	7014
DATE :	14.11.2001 21:43.32	TESTED BY :	H.Muecke
SYSTEM :	LWM250DUV	NUMBER OF MEAS :	30
CUSTOMER :	FEI USA	TYPE OF SAMPLE :	Testmaske 02
		S/N OF SAMPLE :	6064

GLASS LINES results in micrometers

Nominal	1.DAY		2.DAY		3.DAY		OVER ALL		SPECS
	mean	3 sigma	mean	3 sigma	mean	3 sigma	mean	3 sigma	3 sigma
0.3	0.2751	0.0008	0.2756	0.0010	0.2751	0.0007	0.2753	0.0011	0.003
0.5	0.3909	0.0008	0.3912	0.0007	0.3914	0.0006	0.3912	0.0009	0.003
0.7	0.5990	0.0011	0.5995	0.0010	0.5996	0.0008	0.5994	0.0012	0.003
1.1	0.9710	0.0010	0.9713	0.0010	0.9712	0.0007	0.9712	0.0010	0.003
2.2	2.0398	0.0006	2.0404	0.0008	2.0400	0.0007	2.0400	0.0010	0.003
3.2	3.0367	0.0005	3.0369	0.0006	3.0369	0.0007	3.0368	0.0007	0.003
4.6	4.4108	0.0008	4.4110	0.0006	4.4108	0.0006	4.4109	0.0007	0.003

CHROMIUM LINES results in micrometers

Nominal	1.DAY		2.DAY		3.DAY		OVER ALL		SPECS
	mean	3 sigma	mean	3 sigma	mean	3 sigma	mean	3 sigma	3 sigma
0.3	0.3249	0.0008	0.3246	0.0008	0.3248	0.0010	0.3248	0.0010	0.003
0.5	0.6142	0.0012	0.6139	0.0008	0.6137	0.0010	0.6139	0.0011	0.003
0.7	0.8019	0.0009	0.8016	0.0009	0.8015	0.0007	0.8017	0.0010	0.003
1.1	1.2267	0.0005	1.2263	0.0009	1.2267	0.0006	1.2265	0.0008	0.003
2.2	2.3588	0.0004	2.3583	0.0005	2.3588	0.0006	2.3586	0.0008	0.003
3.2	3.3611	0.0007	3.3609	0.0008	3.3613	0.0005	3.3611	0.0008	0.003
4.6	4.7751	0.0007	4.7751	0.0007	4.7753	0.0008	4.7752	0.0008	0.003

CONFIRMED BY SIGN:

/V. Rey/

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ACCEPTANCE TEST PROTOCOL DUV ILLUMINATION

MZD MASK - Y DIRECTION

LEICA ORDER :	117728	SERIAL NUMBER :	7014
DATE :	14.11.2001 21:41.33	TESTED BY :	H.Muecke
SYSTEM :	LWM250DUV	NUMBER OF MEAS :	30
CUSTOMER :	FEI USA	TYPE OF SAMPLE :	Testmaske 02
		S/N OF SAMPLE :	6064

GLASS LINES results in micrometers

Nominal	1.DAY		2.DAY		3.DAY		OVER ALL		SPECS
	mean	3 sigma	mean	3 sigma	mean	3 sigma	mean	3 sigma	3 sigma
0.3	0.2835	0.0014	0.2842	0.0019	0.2838	0.0011	0.2838	0.0017	0.003
0.5	0.3903	0.0012	0.3910	0.0010	0.3910	0.0009	0.3908	0.0014	0.003
0.7	0.5970	0.0008	0.5976	0.0010	0.5976	0.0011	0.5974	0.0013	0.003
1.1	0.9668	0.0009	0.9672	0.0008	0.9677	0.0008	0.9672	0.0014	0.003
2.2	2.0338	0.0010	2.0341	0.0007	2.0339	0.0008	2.0339	0.0009	0.003
3.2	3.0293	0.0013	3.0292	0.0010	3.0295	0.0018	3.0293	0.0014	0.003
4.6	4.4032	0.0010	4.4032	0.0007	4.4031	0.0009	4.4032	0.0009	0.003

CHROMIUM LINES results in micrometers

Nominal	1.DAY		2.DAY		3.DAY		OVER ALL		SPECS
	mean	3 sigma	mean	3 sigma	mean	3 sigma	mean	3 sigma	3 sigma
0.3	0.3159	0.0014	0.3152	0.0015	0.3156	0.0009	0.3156	0.0015	0.003
0.5	0.6145	0.0015	0.6139	0.0015	0.6138	0.0013	0.6141	0.0017	0.003
0.7	0.8038	0.0008	0.8033	0.0009	0.8032	0.0009	0.8034	0.0011	0.003
1.1	1.2308	0.0007	1.2304	0.0008	1.2304	0.0008	1.2305	0.0010	0.003
2.2	2.3652	0.0009	2.3652	0.0011	2.3653	0.0008	2.3652	0.0009	0.003
3.2	3.3677	0.0008	3.3680	0.0007	3.3679	0.0008	3.3679	0.0008	0.003
4.6	4.7824	0.0007	4.7828	0.0008	4.7826	0.0007	4.7826	0.0009	0.003

CONFIRMED BY SIGN:

/V. Ray/

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Packing List LWM250DUV

Order No. : 117728 FEI USA

Box	Content	Amount	checked
G	Base frame	1	✓
R	Rack	1	✓
	PC-keys	4	✓
	back door	1	✓
	caster	2	✓
Z	Bag with assembling parts	1	✓
	Screws for scanning stage	4	✓
	Mikroscope parts		✓
	Allen keys	1	✓
	Screws for Sliding System	4	✓
	Screws for lamp alignment tool	2	✓ Base frame
	Label set		✓
	Spare fuses		✓
	Connection parts		✓
	Cable ties		✓
	Screws for keyboard table	4	✓
	Box with accessories		
enter amount !	Mask holder	1	6025 ✓
	Notchfilter	1	✓
	Mouse	2	✓
	Keyboard for network computer	1	✓
	Backup-CD's	3	✓
	DUV-Lamps	2	2 ✓
	Halogen lamps	~~40~~ 10	10 ✓
	Signal tower + column	1	✓
	Test mask	1	✓
	Earthquake protection	3	✓
	Scanning stage	1	✓
	O-Tube + Alfa + Camera	1	✓
	Support table for camera controller	1	✓
	Camera controller	1	✓
	Camera controller cable	3	✓
	Lamp cover	1	✓
	Sliding system	1	✓
	Frame for lamp power supply	1	✓
	Lamp power supply LEJ EBQX	1	✓
	Lamp house LH200 DUV	1	✓
	Lamp house LH 106 Z	1	✓
	Lamp alignment tool	1	✓
	Keyboard table	1	✓
	Joystick	1	✓
	Keyboard for measurment controller	1	✓
	Monitor	1	✓
check Ser. No. !	Dokumentation PC's	1	✓
	Software manual	2	✓ 1 an Kunde direkt
	Hardware manual	2	✓
	CE declaration for EU customer	1	✓
	DUV-objective	1	✓
	Safety eyewear	1	✓

directly to customer

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Printed Date: 09-28-2001 16:30

Certificate of Conformance

Photronics, Inc.
Photronics MZD GmbH & Co. KG
Grenzstrasse 28
Dresden D-01109
Phone (49)351-885-28-0 Fax (49)351-885-2835
www.photronics.com

Bill to: LEICA MIKROSYSTEMS WETZLAR GMBH
Ship to: LEICA MICROSYSTEMS WETZLAR GmbH
PO #: 222/4500077564
Release #:
PO Line Item #: 01

Order Date: 09-13-2001
Order Type: Standard
Photronics Job #: 11003633
Compact: B8060-1101 ABS A/S AMBER 6" X 250- 6"

General Mask Information

Part #: Testmaske 02 / CD-Normal 6Z 64
Device: CD_Normal/11301383086000
Set ID: 7999
Fiducial Type:
Mask Title : CD_Normal_64
Device Title:
Customer Serial #:
Customer Specification #:

Product Type: 1X Beam Final
Material: HO 6 x 6 x .25 IN EQAR
Photronics Plate #: 11019896
Photronics Serial #: 10219896
Barcode 1:
Barcode 2:
Barcode 3:

Lithography

System: LEICAZBA_31H 102 Litho Site: Dresden Write Date / Time: 09-28-2001 06:27 Total Write 93 minute(s)

Critical Dimensions

System: MPVCD2-BMG2

CD Location and size			Parameter	Tolerance	Method	FYI
Field: 1 Axis: X	Pattern: Primary - CX11 Feature: F	Tone: Clear Nominal: 1.0500	1st Tolerance 1st Uniformity	+ 0.0400 - 0.0400 ± 0.0600	Mean Deviation From Nominal Range (Max-Min)	Y Y

CD Readings: 1.0300 1.0300 1.0300 1.0200 1.0300

Axis Statistics:	Min:	Mean:	Max:	Mean deviation from nominal	RANGE Uniformity
	1.0200	1.0280	1.0300	-0.0220	0.0100

System: MPVCD2-BMG2

CD Location and size			Parameter	Tolerance	Method	FYI
Field: 1 Axis: X	Pattern: Primary - CX32 Feature: F	Tone: Clear Nominal: 3.1500	1st Tolerance 1st Uniformity	+ 0.0400 - 0.0400 ± 0.0600	Mean Deviation From Nominal Range (Max-Min)	Y Y

CD Readings: 3.1400 3.1300 3.1300 3.1400 3.1400

Axis Statistics:	Min:	Mean:	Max:	Mean deviation from nominal	RANGE Uniformity
	3.1300	3.1360	3.1400	-0.0140	0.0100

System: MPVCD2-BMG2

CD Location and size			Parameter	Tolerance	Method	FYI
Field: 1 Axis: X	Pattern: Primary - CX80 Feature: F	Tone: Clear Nominal: 7.9500	1st Tolerance 1st Uniformity	+ 0.0400 - 0.0400 ± 0.0600	Mean Deviation From Nominal Range (Max-Min)	Y Y

CD Readings: 7.9700 7.9700 7.9700 7.9800 7.9700

Axis Statistics:	Min:	Mean:	Max:	Mean deviation from nominal	RANGE Uniformity
	7.9700	7.9720	7.9800	0.0220	0.0100

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System: MPVCD2-BMG2

CD Location and size			Parameter	Tolerance	Method	FYI
Field: 1 Axis: Y	Pattern: Primary - CY11 Feature: F	Tone: Clear Nominal: 1.0500	1st Tolerance 1st Uniformity	+ 0.0400 - 0.0400 ± 0.0600	Mean Deviation From Nominal Range (Max-Min)	Y Y

CD Readings: 1.0300 1.0300 1.0300 1.0300 1.0300

Axis Statistics:	Min:	Mean:	Max:	Mean deviation from nominal	RANGE Uniformity
	1.0300	1.0300	1.0300	-0.0200	0.0000

System: MPVCD2-BMG2

CD Location and size			Parameter	Tolerance	Method	FYI
Field: 1 Axis: Y	Pattern: Primary - CY32 Feature: F	Tone: Clear Nominal: 3.1500	1st Tolerance 1st Uniformity	+ 0.0400 - 0.0400 ± 0.0600	Mean Deviation From Nominal Range (Max-Min)	Y Y

CD Readings: 3.1500 3.1500 3.1500 3.1500 3.1500

Axis Statistics:	Min:	Mean:	Max:	Mean deviation from nominal	RANGE Uniformity
	3.1500	3.1500	3.1500	0.0000	0.0000

System: MPVCD2-BMG2

CD Location and size			Parameter	Tolerance	Method	FYI
Field: 1 Axis: Y	Pattern: Primary - CY80 Feature: F	Tone: Clear Nominal: 7.9500	1st Tolerance 1st Uniformity	+ 0.0400 - 0.0400 ± 0.0600	Mean Deviation From Nominal Range (Max-Min)	Y Y

CD Readings: 7.9500 7.9500 7.9500 7.9500 7.9500

Axis Statistics:	Min:	Mean:	Max:	Mean deviation from nominal	RANGE Uniformity
	7.9500	7.9500	7.9500	0.0000	0.0000

Defect Inspection

Method				Minimum Defect Specs			Maximum Defect Specs			Results	
Insp Type	Area / Pattern	Rotated	System	Method	Size	Limit	Method	Size	Limit	Min	Max
MANUAL	Non-Auto Inspected areas	N	Microscope	DPA	2.000	33.000	-	-	-	0.000	-

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Particle Inspection

Surface Inspected	Defect Size	Defect Method	Defect Limit
Chrome	2.000	DPA	33.000
Glass	4.000	DPA	33.000
Pellicle	10.000	DPA	0.000

Abnahmeprotokoll INM 200/400 / LFS

acceptance protocol

1 Allgemeines – general Remarks

Verantwortlich für die Abnahme: Bokuwerfel Datum: 01 / 10 / 01

Responsible for acceptance: Date

3.1 Konfiguration – configuration

3.1.1 Auftragsnummer: ______ / ____ / ____ Kunde: ____________

Order No. Customer

3.1.2 Konfigurationserfassung: ORH ☐ – registration of configuration

Nr. = No

Stativ-Typ: (stand (microscope type))	INM 200 AL	020-654.111-000	☐	Stativ-Nr.	: 122
	DUV INM 200 AL/DL	020-654.112-000	☒	Elektronikbox-Nr. (electronics box)	:______
	INM 200 H	020-654.113-000	☐	LFS-Nr.	: 4554 ← LFS = Laser focus system → automatic focus system
	INM 200 P	020-654.114-000	☐	Int.Lamp.Vers. Nr. (internal light version No.)	:______
	INM 400	020-655.101-000	☐	Kreuztisch-Nr. (manual microscope stage)	:______
	INS3000	020-656.006	☐	Scanningtisch-Nr. (motorized microscope stage)	:______

Typenschilder E-Box, Stativ, Lampennetzteil vorhanden (type labels) i.O. ☐

Lampenhaus Typ: (lamp house)	LH106Z ☒	______ ☐	Ext.Lamp.Vers.Nr.:______		
Zwischenstücke: (Adapter)	39 mm ☐	54 mm ☐	14mm ☒		
Tubus-Typ: (tube type)	FSA VV ☐	FSA VR ☐	FSA V ☐	:______	
Pult: (desk)	SA ☐	______ ☐			
TV-Modul-Typ:	1x ☐	______ ☐			
Konfokalmodul:	☐	Nr.:______	Hg-Lamp.vers.Nr.:______		

Autom. Strahlteiler: (automatic beam splitter)	☒	Man. Fluo-Strahlteiler:	☐	Man. Strahlteiler:	☐
Autom. ICR-Einricht.: (device)	☐	Man. ICR-Einrichtung:	☐		
Filtermodul:	☐	Spiegelhaus 105:	☐		
Kondensor f. DUV (condensor for DUV)	☒	Mot. Polarisator:	☐		
Leuchtfeldblende DL: (imaging field stop)		Iris ☐		Vierkant ☐	

DUV = deep ultraviolet illumination

Okulare: (eye pieces) L PLAN 10x/25 ☐ ______________ ☐

Objektive: (objective lens system)						
PL Apo :						
PL Fluotar:	2.5x		20x BD			
HC PL Fluotar:	[illegible]	5x				
UV:						
DUV :					150x	

Bemerkungen: (remarks) ______________________________________

____

____

____

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acceptance prot

serialnumber of

3.1.3 Seriennummern der Leiterplatten:

Leiterplatte

Leiterplatte	lfd. Nr.	ÄZ	Eprom-Versions-Nr.
Basic-Modul	1323	04	301-360.041-010
Master-Modul	1550	03	301-389.033-012
LZAM-Modul	1580	05	301-389.043-012
ICR	-----	-----	301-360.193-____
Pult	-----	-----	301-336.132-____

3.2 Sichtprüfungen — visual tests

3.2.1 Allgemeinzustand: i.O. ☑

3.2.2 Maßnahmen zu EMV, E-Box: i.O. ☑

3.3 Elektrische Sicherheitsprüfungen — electrical safety tests

3.3.1 Ableitstrom: 0,4 mA — < 2,0 mA

3.3.2 Isolationswiderstand: i.O. ☑ — > 10 MΩ

3.3.3 Schutzleiterwiderstand: 40 mΩ — < 100 mΩ

3.3.4 Hochspannungsprüfung: 1,3 kV bestanden ☑

3.3.5 Potentialausgleich: mit Sicherheitsprüfplatz

	von Schutzleiteranschluß zu: (Differenz bilden)						
Schutzleiter-anschluß	Stativ-obert.	Stativ-untert.	Tubus	ggf. Conf.M.	ggf. TV-Mod.		
40 mΩ	5	5	5	/	/	mΩ	< 100 mΩ

3.4 UV Sicherheitsprüfung — safety test (bei INS3000: mit INS3000 Zwischentubus!)

HBO-Lampe nach 140 Stunden durch eine Neue ersetzen, Betriebsstundenzähler überwachen!

Prüfpunkt	Meßwert	Gigahertz im Adapter mit vorgesetztem I-Line Filter	Toleranz
Intensität rechter Okularabgang: mit LFS Präparat auf Aluminium (82% Schicht neben Gold)	/ nW/cm² i.O. ☐	Apertur 4, HC 10x/25 Okular mit "Augenring", Okularabgang 100%	< 10 nW/cm²
Intensität am ☒ Kamera- oder ☐ Doppel-TV-Abgang	DUV 5 µW/cm²	Detektor direkt auf Kameraabgang	Kamera: > 10µW/cm² Doppel-TV: > 3,3 µW/cm²
Warnschild Kamera-abgang vorhanden	i.O. ☑	Dreieck mit Ausrufezeichen	nur bei bestandener Intensitäts-prüfung
Beilegeblatt „UV" vorhanden	i.O. ☑	zur Bedienungsanleitung oder darin integriert	
UV-Kennzeichnung auf Typenschild: UV365 DUV ?	~~i.O. ☐~~	INM200: Tubus und Stativ, INS3000: Zwischentubus	

3.4 Netzteile — power supplies

3.5.1 /3.5.2 Spannungsumschalter / Stromaufnahme

U_{prim}	I_{prim}	U_{sek} E/A	Spezifikation
		+13V	
230V	0,13A	–	± 0,5 V
120V	0,2 A	–	± 0,5 V

U_{prim}	U_{sek} Elba						
	+5V	+8V	+12V	-12V	+12V*	-12V*	+24V
230V	–	+8,05	+12,02	-12,04	+12,17	-12,11	+24,32
120V	–	+8,06	+12,02	-12,04	+12,17	-12,11	+24,32

Spezifikation: *=12V für Motor ± 0,5/0,12/0,12 0,12/0,36/0,36 /0,5V

Meßprotokoll von Fa. Elba vorhanden: i.O. ☑

Sicherungswerte nach Zeichnung 301-360.045-000: i.O. ☑

3.5.3 Linearität Lampenstrom → linearity of lampcurrent

Steuerspannung	Lampenstrom	Spezifikation
2 V	A	(2 ± 0,1) A
8,25V	A	(8,25±0,4) A
10 V	A	

3.6 Mechanisch-optische Prüfungen — mechanical-optical tests

3.6.1 Z-Trieb

		Spezifikation
Verfahrweg	20,88 mm	LWM250: 21 - 0,3 mm INS3000: 6,9 - 0,5 mm INM200: 30 - 0,3mm INS3000: ~~6 - 0,3mm~~
Funktion Präparatschutz	115 µm	90 .. 120 µm
Z-Ablauf x/y (Scan/Hand)	µm	<30µm/<80µm
Funktion mit Last 12kg	☑ i.O.	

3.6.2 Lampenjustage — lamp adjustment

Lampenjustage durchgeführt und i.O. ☑

3.6.3 Tubus — tube lens system

1 Skt = 0,1 mm

		Spezifikation
Mittigkeit Tubussitz	mm	< 0,1 mm
Mittigkeit Vergrößerungswechsler	mm	< 0,1 mm
Mittigkeit Fotoabgang	mm	< 0,1 mm
Tubus-Strahlteiler: Sprung von der Mittelstellung zu den beiden äußeren	mm	< 0,1 mm
Funktion Tubusklappe	☐ i.O.	
Reflexfreiheit Kameraabgang	☐ i.O.	

3.6.4 Blendenmodul "⊙" — light stop module

Aperturblenden — aperture stop

	Bl. 1	Bl. 2	Bl. 3	Bl. 4	Bl. 5	Spezifikation
Aperturblendenmitte	✓	✓	✓	✓	✓	±0,05mm (±1 Skt.)
Reproduzierbarkeit Aperturblendenmitte	✓	✓	✓	✓	✓	±0,05mm (±1 Skt.)

Leuchtfeldblende field stop

Umschaltfunktion HF / DF / Gelbfilter : i.O. ☑

Mittigkeit DF-Blende: i.O. ☐

Hellfeld/Dunkelfeld (Mittenstop) – bright field / darkfield stop

Ausleuchtung HF: homogen ☑

Ausleuchtung Dunkelfeld:
homogen, ohne Aufhellungen und ohne Reflexe: i.O. ☑

Graufilter

Graufilter schaltet: i.O. ☑

3.6.5 Objektiv Mitten- und Höhenabstimmung "⊙" — objective centrality and height calibration (+ zählt in Richtung Objektiv)

DUV?

✓ means: DUV objective is reference objective for settings

Objektiv	Mitte	Höhe	Mitte	Höhe ohne	mit LFS
☐ 1,6x/ ☐ 2,5x	Skt.	µm	±4Skt	+100 -200µm	
5x	Skt.	µm	±1Skt	±50 /	60µm
10x	Skt.	µm	±1Skt	±20 /	30µm
20x	Skt.	µm	±1Skt	±10 /	30µm
50x	Skt.	µm	±1Skt	±4 /	20µm
100x	Skt.	µm	±1Skt	0 µm	
150x	Skt.	µm	±1Skt	± 2 /	20µm
150x UV	Skt.	µm	±1Skt	± 2 /	20µm
250x	Skt.	µm	±1Skt	± 2 /	20µm

Bezug: Mittigkeit festes Auge Nr. 5, Höhenabstimmung Objektiv 100x
relation: centrality of fixed eye No. 5, height adjustment (usually) to objective 100x;
[remark: handwritten "DUV" above shows that related objective is the DUV in position 5 of nosepiece (compare to page 4, listing of "Hardware")]

3.6.6 Mitten-Wiederholgenauigkeit bei Umschlagen Revolver "⊙" fest/Präp.schutz:

DUV?

		fest/Präp.schutz
Wiederholgenauigkeit Obj. ____x:	µm	±1 / ±8 µm
Wiederholgenauigkeit Obj. ____x:	µm	±1 / ±8 µm
Wiederholgenauigkeit Obj. ____x:	µm	±1 / ±8 µm
Wiederholgenauigkeit Obj. ____x:	µm	±1 / ±8 µm
Wiederholgenauigkeit Obj. ____x:	µm	±1 / ±8 µm

3.6.7 Tubuslinse tube lens

Abbildungsleistung mit Obj. 10x im gesamten Feld: i.O. ☑

manual beam splitter module
3.6.8 Manuelles Strahlenteilermodul
Ausleuchtung: HF i.O. ☐ DF i.O. ☐

automatic beam splitter modul
3.6.9 Automatisches Strahlenteilermodul
Funktion Umschaltung HF/DF zu ICR und Fluo i.O. ☑
Sicherheitsabfrage i.O. ☑
Ausleuchtung: HF i.O. ☑ DF i.O. ☑

fluorescence beam splitter module
3.6.10 Fluoreszenz-Strahlenteilermodul
Ausleuchtung: HF i.O. ☐ DF i.O. ☐
Funktion Sicherheitssperre: i.O. ☐

3.7 LFS → Laser focussing system = autofocus system

3.7.1 Laserleistung messen, Sicherheitsschaltung → measurement of laser power, safety settings

Einstellung der Spannung mit den Potentiometern nur von oben nach unten (Hystere der Potis!), gegebenenfalls nochmals von oben starten! Laserdiode über Computer auf max. Leistung! Falls kein LFS bestellt, mit eingestelltem LFS die Laserleistung am Objektiv P_E und an der Tubuslinse überprüfen!
Auf gültige Kalibrierung des Sensors und Meßgeräts achten!

	U (X1)	Laserleistung	Spezifikation
mit R10 (10kOhm) Laserstrom einstellen,	7,93 V	P_7: 12,08 µW	Spitzenlaser-strom 7 Ampere
Stromzange entfernen, den Jumper bis zum Anschlag aufstecken, R12 an den oberen Anschlag drehen!			
gegebenenfalls mit R10 Laserleistung weiter reduzieren	U_G: 5,53 V	P_G: 11,53 µW	$P_G \leq 15$ µW $P_G \leq P_7$
R12 (1kOhm) runterdrehen bis zum Maximum:	5,25 V	P_X: 12,29 µW	$P_X \leq 16$ µW
Spannung mit R12 weiter reduzieren, eine Spannung von U_G - 0,02V einstellen	5,51 V	P_{12}: 11,45 µW	$U \leq U_G$-0,02V $P_{12} \leq P_G$
DVM mit Meßleitungen entfernen, Laserleistung messen	-----	P_E: 11,45 µW	$P_E \leq P_{12}$+0,5µW

Potentiometer R10 und R12 mit Lack sichern! i.O. ☑

	Meßwert	Sicherheit! Grenzwert
FSA / Tubuslinse	1 nW	≤ 1000 nW

centrality of laser spot
3.7.2 Laserspot-Mittigkeit "*" Tubus mittlere Kippung, Augenabstand 65 mm

Vor Dauerlauf		Nach Dauerlauf		Spezifikation
x: 0 Skt	y: 0 Skt	x: +0,5 Skt	y: 0 Skt	mit Obj. 100x: ± 1 Skt.

controlling of laser current

3.7.3 Laserstromregelung minimaler Laserstromwert. 119 digit

	Obj. 100x, GF ein, 1%	Obj. 50x, GF aus, 96%	Obj. 250x, GF aus, 1%	< 140 digit
Signal Summe	+9	10,5	+6	> 2 V
Summe in digit	------------	------------	155	> 43 digit
Signal + Diff	+7	+8	+3,5	--------
Signal - Diff	-7,5	-7,5	-4	--------

3.7.4 Optischer Offset – optical offset

Verfahrweg der Offsetverstellung: 14,387 mm (14 +1/-0,3) mm

Objektiv-Typ	Pl Apo	Pl Apo	PL Apo	PL Apo
Vergrößerung	250x	150x	100x	50x
Offset Position 1%	2,794	3,715	5,316	6,157
Objektiv-Typ	PLFL	PLFL	PLFL	
Vergrößerung	20x	10x	5x	
Offset Position 1%	6,535	7,053	6,928	

Pl Fluotar 100x: (9,5± 0,5) mm

Pl Apo 100x: (5,5± 0,5) mm

optical (= visual) impression of focussing

3.7.5 Optischer Fokussiereindruck "*", "⊙" → remark: tests are carried out with replacement of a standard set of objectives if the customer does not order all available objectives

(*) Reflektivität	96 %		82%	60%	28%	4,2%	1 %	
Obj.vergröß.	⊙	*	⊙	⊙	⊙	⊙	⊙	*
250x	O	O	O	O	O	O	O	O
150x	O	O	O	O	O	O	O	O
100x	O	O	O	O	O	O	O	O
50x	O	O	O	O	O	O	O	O
20x	O	O	O	O	O	O	O	O
10x	O	O	O	O	O	O	O	O
5x	O	O	O	O	O	O	O	O

objective magnification

keys

Schlüssel: 0 i.O. – o.k.
1 schwingen – swinging
2 überlaufen – override
3 Einlauf langsam – slowly running in focus position

3.7.6 Umschlagfokussieren "⊙" (Objektiv-Vergrößerungen bitte eintragen.)

change of objective

Objektivwechsel	"⊙"	Objektivwechsel	"⊙"
5 x -> 10 x	✓	250 x -> 100 x	✓
10 x -> 20 x	✓	100 x -> 50 x	✓
20 x -> 50 x	✓	50 x -> 20 x	✓
50 x -> 100 x	✓	20 x -> 10 x	✓
100 x -> 250 x	✓	10 x -> 5 x	✓
min. V. - > max. V. 5 x -> 250 x	✓	max. V. -> min. V. 250 x -> 5 x	✓

focussing after change of objective by turn of nosepiece

Präparat 1%

(*) reflectivity of different surface areas of a standardized substrate, each area having a defined reflectivity

automatic correction of focussing after movement of stage
3.7.7 Nachfokussieren bei Tischbewegung

Obj.	5x	10x	20x	50x	100x	150x	250x
i.O.	✓	✓	✓	✓	✓	✓	✓

laser power after long time test, type label
3.7.8 Laserleistung nach Dauerlauf, Typenschild

	Meßwert
aktuelle Messung am Revolver	11,21 µW
Übertrag aus Messung 3.7.1: P_E	11,45 µW
Differenz bilden:	- 0,24 µW

Differenz der Laserleistung zwischen + 0,5 µW und - 1 µW; Produkthaftungs- und Sicherheitsrelevanz

Potentiometer R10 und R12 sind noch mit Lack gesichert? **Ansonst Punkt 3.7.1. wiederholen!** i.O. ☑

Deckel mit Schutzschrauben verschliessen i.O. ☑

Typen- und Warnschild über Deckel und Grundplatte aufkleben i.O. ☑

Obj. 250x, GF aus, 1%, Summe in digit 155 digit — >43 digit.

electrical interfaces
3.8 Elektrische Schnittstellen

3.8.3 TV-/Confocal-Modul- und Tubus-Schnittstelle (intern)	Funktion TV-/Confocal-Modul Funktion Tubus i.O.	i.O. ☐ i.O. ☑
3.8.4 Autom. Strahlteilermodul	Funktion	i.O. ☑
3.8.5 Automatisiertes ICR-Modul	Funktion	i.O. ☑

Zum Test nachrüsten, falls nicht alle Komponenten in Auftrag enthalten sind!

long time test

3.9 Dauerlauf	Datum / Zeit	Zykluszahl
Beginn	25.9.01	0
Ende	26.9.01	5000

min. 48 h und min. 5000 Zyk.

test of functions
3.10 Funktionsprüfungen

transmittance light device
3.9.1 Durchlicht-Einrichtung Prüfung, falls vorhanden

Verstellung Kondensor symmetrisch: i.O. ☐

Leuchtfeldblenden-Funktion: i.O. ☐

Ausleuchtung gleichmäßig: i.O. ☐

cleanness of optical elements
3.10.2 Sauberkeit der Optik

Objektive (Frontlinsen)	i.O. ☑	Sichtbare Glasflächen	i.O. ☑
Tubuslinse	i.O. ☑		

camera module
3.10.3 TV-Modul Prüfung, falls vorhanden

Mittigkeit FSA-Abgang: i.O. ☐ <0,1 mm

Mittigkeit TV-Abgang: i.O. ☐ <0,1 mm

3.10.4 Manuelle ICR-Einrichtung — manual ICR device   Prüfung, falls vorhanden — only tested if ordered (device)

Funktion Analysator, Polarisator: i.O. ☐   Prüfer

Objektiv	150x	100x	50x	20x	10x	5x
Isogyrenkreuz						
Dunkelstellung						
Farbumschlag						

Einstellung des ICR vor Punkt 3.6.4 durchführen!

3.10.5 Automatisches ICR-Modul — automatic ICR module   Prüfung, falls vorhanden — only tested if ordered (module)

Funktion: i.O. ☐

Verstellung feingängig: i.O. ☐   Prüfer

Objektiv	150x	100x	50x	20x	10x	5x
Isogyrenkreuz						
Dunkelstellung						
Farbumschlag						

Einstellung des ICR vor Punkt 3.6.4 durchführen!

3.11 Weiteres — additionals

3.11.1 Watchdog   Basic-Modul: i.O. ☑

Z-Platine: i.O. ☐

3.11.2 Sichtprüfung — visual test

CE-Zeichen vorhanden: ☑

Prüfaufkleber Lampennetzteil vorhanden: ☑

Warnhinweis "Kabelfarben .." vorhanden: ☑

Warnhinweis "Vor Öffnen .." vorhanden: ☑

Schutzleitersymbol vorhanden: ☑

Kennzeichnung Spannungswahlschalter vorhanden: ☑

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3.11.3 Oberflächen — surfaces

Oberflächen: i.O. ☑

3.12 Dokumentation — documentation (manuals)

Bedienungsanleitung liegt bei: ☐

Option VISCON: Softwareanleitung liegt bei ☐

Option Scanningtische: Anleitung liegt bei ☐

Serviceanleitung optional: ☐

Anleitung zu externen Lampenversorgungen: ☐

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Bemerkungen: